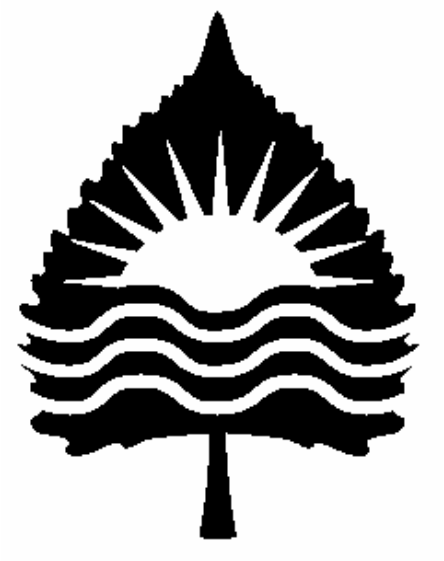


Total Maximum Daily Loads for the Loup River Basin

(Segments LO1-10000, LO1-30000, LO1-30300, LO2-10000, LO2-11400, LO2-30000, LO2-40000, LO3-10000, LO3-50300, LO4-10000 and LO4-20000)

Parameter of Concern: *E. coli* Bacteria

Nebraska Department of Environmental Quality
Planning Unit, Water Quality Division

December 2005

Table of Contents

List of Figures and Tables

Executive Summary

Twelve segments in the Loup River Basin were included in the 2004 Nebraska Surface Water Quality Integrated Report (NDEQ 2004) in Category 5 as impaired by excessive *E.* coli. As such, total maximum daily loads (TMDLs) must be developed in accordance with the Clean Water Act. During review of the data in preparation for TMDL development it was discovered that segment LO3-30000 was inappropriately identified as impaired. The data collected in 2003 indicated the recreation season geometric mean for LO3-30000 to be 102/100 ml. Because this waterbody does not exceed the water quality criteria of 126/100 ml, no TMDL will be developed and the waterbody will be delisted in the 2006 submittal.

Based on the strategy of a basin wide approach as well as the hydrologic connections, TMDLs have been developed and included for eleven waterbodies. In 2002, the Department opted to convert from fecal coliform to *E.* coli bacteria as the indicator for primary contact recreation assessment. This document presents TMDLs for *E. coli* that are designed to allow the Loup River Basin segments to fully support the primary contact recreation beneficial use. The information contained herein should be considered eleven TMDLs.

These TMDLs have been prepared to comply with the current (1992) regulations found at 40 CFR Part 130.7.

1. Name and geographic location of the impaired waterbody for which the TMDLs are being developed.
Loup River Basin Segments: LO1-10000, LO1-30000, LO1-30300, LO2-10000, LO2-11400, LO2-30000, LO2-40000, LO3-10000, LO3-50300, LO4-10000 and LO4-20000.

2. Identification of the pollutant and applicable water quality standard
The pollutant causing the impairment(s) of the water quality standard and designated beneficial use is *E. coli* bacteria. Designated uses assigned to the above-identified segments include: primary contact recreation, aquatic life Coldwater Class B and Warmwater class A, agriculture water supply class A and aesthetics (NDEQ 2002b). Excessive *E. coli* has been determined to be impairing the primary contact recreation beneficial uses. The applicable water quality criteria is a recreation season (May 1-September 30) geometric mean of 126/100 ml for *E. coli.*

3. Quantification of the pollutant load that may be present in the waterbody and still allows attainment and maintenance of the water quality standards.
The allowable pollutant load is based upon the available stream flow volume. That is, loading capacities are developed for each flow by multiplying the water quality standard (WQS) by the selected stream flow and a conversion factor (C) with the equation being:

$$\text{Loading capacity} = \text{WQS} * \text{Flow} * \text{C}$$

4. Quantification of the amount or degree by which the current pollutant load in the waterbody, including upstream sources that is being accounted for as background loading deviates from the pollutant load needed to attain and maintain water quality standards.

Segment	*E. coli* - # colonies >126/100 ml
LO1-10000	450
LO1-30000	63
LO1-30300	318
LO2-10000	69
LO2-11400	202
LO2-30000	22
LO2-40000	57
LO3-10000	77
LO3-50300	121
LO4-10000	203
LO4-20000	266

5. Identification of the pollutant source categories.
Both point and nonpoint sources (including natural sources) have been identified to be contributing to the pollutant loads being delivered to the Loup River Basin segments.

6. Wasteload allocations for pollutants from point sources.
The wasteload allocations for point source discharges will be equivalent to the water quality criteria associated with the primary contact recreation beneficial use. Therefore, the WLA is a monthly geometric mean of 126/100 ml.

7. Load allocations for pollutants from nonpoint sources.
The load allocations assigned to these TMDLs will be based upon the stream flow volume and will be defined as:

$$LA_i = Q_i * 126/100 \text{ ml} * C$$

Where:
LA_i = load allocations at the i^{th} flow
Q_i = stream flow at the i^{th} flow
126/100 ml = applicable/target water quality criteria for *E. coli* from Title 117
C = conversion factor

8 A margin of safety.
These TMDLs contain an implicit and explicit margin of safety. Specifically, decay/die-off from the potential source to the recreational segment was not included in the pollutant source evaluation, all point sources were assumed to be discharging the expected concentration. As well, the targeted reduction will focus on achieving 90% of the water quality target (≤113/100 ml).

9. Consideration for seasonal variation.
The water quality criteria are only applicable during the Title 117 defined recreation season that starts May 1 and ends September 30. Because of this, the water quality and stream volume data was limited to this time period.

10. Allowances for reasonably foreseeable increases in pollutant loads.
There was no allowance for future growth included in these TMDLs.

11. Implementation Plan

Implementation of the reductions for *E. coli* will be carried out through a combination of regulatory and non-regulatory activities. Point sources will be regulated under the auspice of the National Pollutant Discharge Elimination System and the Rules and Regulations Pertaining to Livestock Waste Control. Nonpoint source pollution will be addressed using available programs, technical advice, information and educations and financial incentives such as cost share.

The TMDLs included in the following text can be considered "phased TMDLs" and as such are an iterative approach to managing water quality based on the feedback mechanism of implementing a required monitoring plan that will determine the adequacy of load reductions to meet water quality standards and revision of the TMDL in the future if necessary. A description of the future monitoring (Section 4.0) that is planned has been included.

Monitoring is essential to all TMDLs in order to:

- Assess the future beneficial use status;
- Determine if the water quality is improving, degrading or remaining status quo;
- Evaluate the effectiveness of implemented best management practices.

The additional data collected should be used to determine if the implemented TMDLs has been or is effective in addressing the identified water quality impairments. As well the data and information can be used to determine if the TMDLs have accurately identified the required components (i.e. loading capacity, load allocations, etc.) and if revisions are appropriate.

1.0 Introduction

Twelve segments within the Loup River Basin were listed in Category 5 of the 2004 Nebraska Surface Water Quality Integrated Report (Integrated Report) (NDEQ 2004). Category 5 waterbodies are deemed impaired and in need of a TMDL. Data collected in 2003 indicate the primary contact recreation beneficial use is impaired with the pollutant of concern being *E. coli* bacteria. Table 1 below provides information of the 2002 Section 303(d) (NDEQ 2002a) list and the 2004 Integrated Report assessments for all of the segments in the Loup Basin designated with the primary contact recreation beneficial use.

Table 1. Section 303(d) Listing and Integrated Report Summary for the Loup River Basin in 2002 and 2004

Segment ID	2002 Section 303(d) list	2004 Integrated Report
LO1-10000	Part 1	Part 5
LO1-30000	Part 1	Part 5
LO1-30300	Part 1	Part 5
LO2-10000	Part 1	Part 5
LO2-11300	Part 1	Part 4C
LO2-11400	Part 1	Part 5
LO2-20000	Part 1	Part 4C
LO2-30000	Part 1	Part 5
LO2-40000	Part 5	Part 5
LO3-10000	Part 1	Part 5
LO3-20000	Part 1	Part 2
LO3-30000	Part 1	Part 5
LO3-40000	Part 5	Part 2
LO3-50000	Part 5	Part 2
LO3-50100	Part 1	Part 4C
LO3-50200	Part 1	Part 2
LO3-50300	Part 1	Part 5
LO3-60000	Part 5	Part 3
LO3-70000	Part 1	Part 2
LO4-10000	Part 1	Part 5
LO4-10200	Part 1	Part 3
LO4-20000	Part 1	Part 5
LO4-30000	Part 1	Part 3

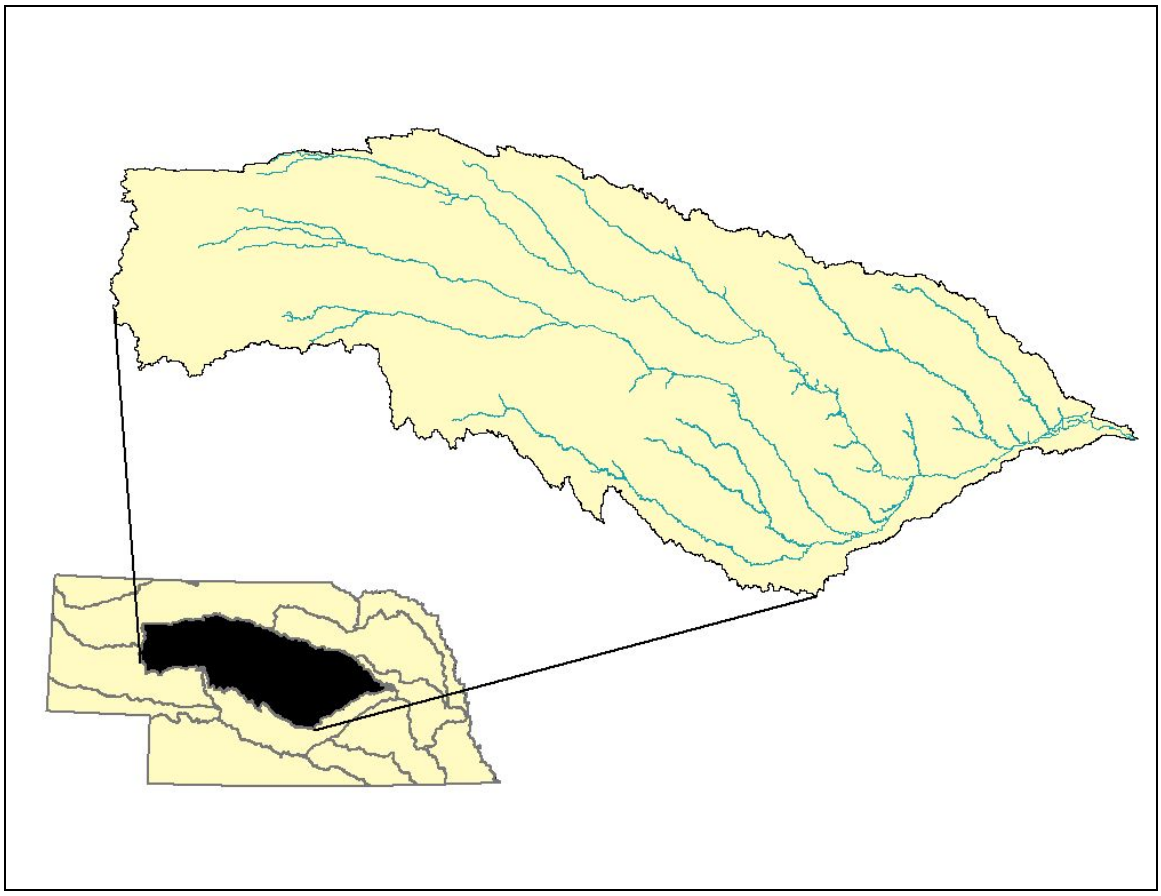
The initial assessment indicated Segment LO3-30000 to be impaired and included on Part 5. A re-examination of the water quality data collected from the segment shows the *E. coli* density to be 102/100 ml, which is below the water quality standard of 126/100ml. As a result of this assessment a TMDL is not needed for the segment and the waterbody will be moved from Part 5 to Part 2 in the 2006 Integrated Report submission.

Based on the above, and as required by Section 303(d) of the Clean Water Act and 40 CFR Part 130, TMDLs have been developed for the impaired waters in the Loup Basin identified in Category 5 of the 2004 Nebraska Integrated Report. The approach for these TMDLs will be to address all of the identified waterbodies simultaneously or as a watershed. Based upon this, the information contain herein should be considered 11TMDLs.

1.1 Background Information

The Loup River Basin located in central Nebraska (Figure 1.1) originates in the Sandhills and flows to a point of confluence with the Platte River near the City of Columbus. Stream flows in the basin are a function of surface run-off and groundwater contributions. Several municipalities reside in the basin ranging from first-class cities to villages.

Figure 1.1 Location of the Loup River Basin



1.1.1 Waterbody Information

1.1.1.1 Waterbody Names and Stream Identification Numbers: Loup River: LO1-10000, LO1-30000, Cedar River: LO1-30300, North Loup River: LO2-10000, LO2-30000 and LO2-40000, Calamus River: LO2-11400, Middle Loup River: LO3-10000, Dismal River: LO3-50300, South Loup River: LO4-10000 and LO4-20000.

1.1.1.2 Major River Basin: Missouri

1.1.1.3 Minor River Basin: Loup

1.1.1.4 Hydrologic Unit Codes: 10210001, 10210002, 10210003, 10210004, 10210005, 10210006, 10210007, 10210008, 10210009 and 10210010

1.1.1.5 Assigned Beneficial Uses: The below provides all of the assigned beneficial uses of the waterbodies for which TMDLs are being developed. Source Title 117 Nebraska Surface Water Quality Standards (Title 117)

Segment	Primary Contact Recreation	Aquatic Life Use	Water Supply	Aesthetics	Key Aquatic Species
LO1-10000	Yes	Warmwater A	Agriculture A	Yes	Title 117: i
LO1-30000	Yes	Warmwater A	Agriculture A	Yes	Title 117: i & j
LO1-30300	Yes	Warmwater A	Agriculture A	Yes	Title 117: i & j
LO2-10000	Yes	Warmwater A	Agriculture A	Yes	Title 117: i
LO2-11400	Yes	Coldwater B	Agriculture A	Yes	Tile 117: 9,15,i & f
LO2-30000	Yes	Coldwater B	Agriculture A	Yes	Title 117: i
LO2-40000	Yes	Coldwater B	Agriculture A	Yes	Title 117: i
LO3-10000	Yes	Warmwater A	Agriculture A	Yes	Title 117: i
LO3-50300	Yes	Coldwater B	Agriculture A	Yes	Title 117: d
LO4-10000	Yes	Warmwater A	Agriculture A	Yes	Title 117: i
LO4-20000	Yes	Warmwater A	Agriculture A	Yes	Title 117: i

Table 1.1.1.5 Title 117 Key Aquatic Species

Species Code	Common Name	Species Code	Common Name
1	Lake sturgeon	c	Brook trout
2	Pallid sturgeon	d	Brown trout
3	Northern redbelly dace	e	Rainbow trout
4	Pearl dace	f	Northern pike
5	Finescale dace	g	Muskellunge
6	Blacknose shiner	h	Blue catfish
7	Lake chub	i	Channel catfish
8	Brook Stickleback	j	Flathead catfish
9	Iowa darter	k	Striped bass
10	Johnny darter	l	White bass
11	Orangethroat darter	m	Rock bass
12	Blacknose dace	n	Largemouth bass
13	Grass pickerel	o	Smallmouth bass
14	Pumpkinseed	p	Spotted bass
15	Golden shiner	q	Redear sunfish
16	Common shiner	r	Bluegill
17	Topeka shiner	s	Black crappie
18	Sturgeon chub	t	White crappie
19	Scaleshell mussel	u	Yellow perch
a	Shovelnose sturgeon	v	Sauger
b	Paddlefish	w	Walleye

1.1.1.6 Major Tributaries: Beaver Creek, Cedar River, Calamus River, Dismal River, Oak Creek and Mud Creek

Table 1.1 Physical Description of the Loup River Basin

Parameter	Loup River Basin
State	Nebraska
Counties (whole or in part)	Arthur, Blaine, Boone, Brown, Buffalo, Cherry, Custer, Dawson, Garden, Garfield, Grant, Greeley, Holt, Hooker, Howard, Logan, Loup, McPherson, Merrick, Nance, Platte, Rock, Sherman, Sheridan, Thomas, Valley and Wheeler
Watershed Area	15,276 mi^2
Sub-basins	4
Designated Stream Segments	105
Stream Miles (designated)	1,833 miles

1.1.2 Watershed Characteristics

1.1.2.1 Physical Features: The Loup River Basin watershed encompasses approximately 15,276 mi^2 in central Nebraska and makes up about one fifth of the state's total area. The basin originates in the sandhills of Sheridan County and stretches approximately 260 miles to Platte County and the confluence with the Platte River (NDNR 1975). The ecoregions of the basin are the Nebraska Sandhills and Central Great Plains (Chapman, et. al. 2001). A majority of the central and western portions of the basin are utilized for cattle ranching purposes with areas of the east and south being used for row crop agriculture and pastures.

The basin is comprised largely of rolling hills except for the stream valleys and a few scattered plains remnants. Large expanses of rolling sandhills in the upper portion gradually give way to the loess plains of the lower basin. In the sandhills area, the surface drainage is often undefined and sometimes nonexistent. The sandhills are separated by broad, flat valleys; dotted with marshes and lakes. The drainage pattern improves in the central and lower part of the basin and is well defined in the loesssial areas.

Base flows in the upper portion of the Loup River Basin are exceptionally uniform due to the discharge of sand a gravel aquifers in the Sandhills area. Lower basin flows are less uniform due to the variability of surface runoff resulting from precipitation in the dissected hard lands of that portion of the basin (NDNR 1975). Water is also diverted or impounded within several reservoirs for use in hydroelectric generation or irrigation purposes.

1.1.2.2 Climate: Precipitation ranges from an annual average of 19 inches in the western end of the basin to 27 inches at the eastern end. Typically, a majority of the precipitation occurs during the spring and early summer. Temperatures in the basin range from an average high in the upper 80's during the summer to average lows in the 10's during the winter (NRC Databank).

1.1.2.3 Demographics: Fifty-six municipal communities reside in the Loup River basin boundaries and range from first class cities to villages. Some of the larger communities include: Columbus – population 20,998, Broken Bow – population 3,491, Ord – population 2,269, St. Paul – population 2,218, Albion – population 1,797, Fullerton – population 1,378, Ravenna – population 1,341 and Burwell – population 1,130.

1.1.2.4 Land Use: About one-third, or three million acres of agricultural lands in the Loup Basin are classified as arable or suitable for cultivation. Approximately, two million acres are classified as suitable for irrigation. Sand and gravel operations are active, primarily along the course of the Loup River and a few silt or siltstone pits are also present in southern Rock County.

Soils of the basin vary from the clean sand of the sandhills where little soil formation has occurred to the loess hills and plains where deep, good quality soil exists. Five soil formations are present (NDNR 1975).

2.0 *E. coli* TMDL

2.1 Problem Identification

Segments LO1-10000, LO1-30000, LO1-30300, LO2-20000, LO2-11400, LO2-30000, LO2-40000, LO3-10000, LO3-50300, LO4-10000 and LO4-20000 were included in Category 5 of the 2004 Integrated Report as having an impaired primary contact recreation beneficial use with the parameter of concern being *E. coli* bacteria. This section deals with the extent and nature of the water quality impairments caused by excessive *E. coli* bacteria in the Loup River Basin. The Integrated Report also included segment LO3-30000 as impaired however, the data indicated the waterbody is fully supporting the primary contact recreation use and the listing was an error. A TMDL will not be developed for segment LO3-30000 and the waterbody will be relocated in the 2006 Integrated Report submission.

2.1.1 Water Quality Criteria Violated and/or Beneficial Uses Impaired

The Primary Contact Recreation beneficial use has been deemed impaired on the above-identified segments. The Primary Contact Recreation beneficial use applies to surface waters which are used or have the potential to be used for primary contact recreation that includes activities where the body may come into prolonged or intimate contact with the water such that water may be accidentally ingested or sensitive body organs (e.g. eyes, ears, nose) may be exposed (NDEQ 2002b). Waterbodies in the Loup Basin assigned the primary contact recreation are identified in Figure 2.1.1.

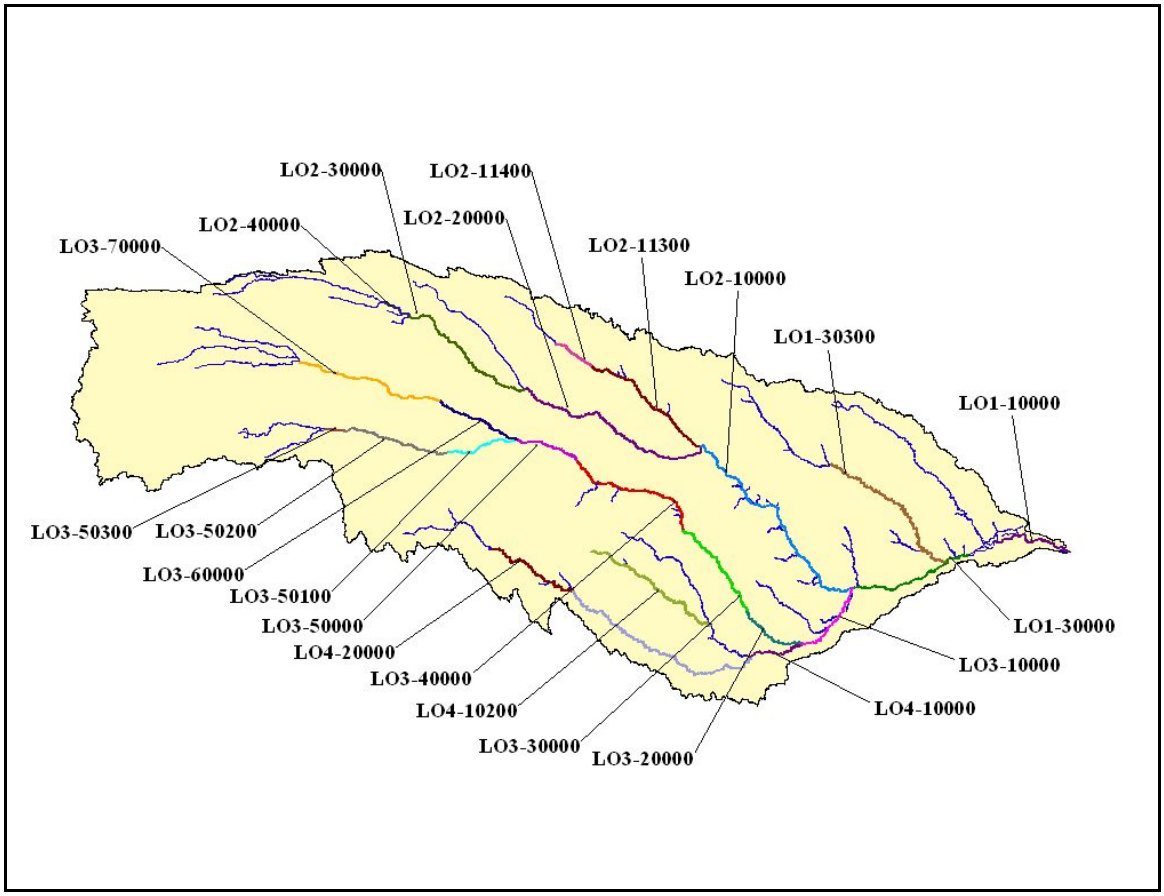
2.1.2 Data Sources

The Nebraska Department of Environmental Quality (NDEQ) monitors surface waters based upon a rotating basin scheme, whereby monitoring is limited to two or three river basins each year with all 13 basins being (partially) examined in a five year period. Under the auspice of the rotating basin plan, data was collected from the Loup River Basin in 1998 and 2003. Data collected in 2003 included stream flow (volume) information and will be used for these TMDLs. Stream flow data and information were obtained from the United States Geological Survey (USGS) and Nebraska Department of Natural Resources (NDNR) who operates the monitoring gages.

During the triennial review of Title 117 – Nebraska Surface Water Quality Standards (Title 117), conducted in 2002, the Department proposed and ultimately received EPA approval to add *E. coli* as a parameter to assess primary contact recreation. The change was pursued based on EPA recommendations that states adopt the *E. coli* indicator, as the organism is more scientifically defensible than fecal coliform. It is the Department's intention to remove fecal coliform as a Title 117 parameter in the future.

With the adoption of *E. coli* as the parameter to assess the recreation use and the advances of analytical techniques; fecal coliform data was not obtained during 2003. Because fecal coliform will be removed as criteria in the future, these TMDLs will focus on the attainment of the primary contact recreation beneficial use, using only *E. coli*.

Figure 2.1.1 Loup Basin Stream Segment Assigned the Primary Contact Recreation Beneficial Use



2.1.3 Water Quality Assessment

Water quality data assessments were based upon the beneficial use assessment procedures used to identify Category 5/impaired waters for the 2004 Integrated Report. The procedures are based on the application of the "binomial distribution" method that applies a confidence interval to the exceedance rate in an effort to determine the true exceedance of the waterbody versus the data set. A complete description of the water quality data assessment procedures can be found in the *Methodologies for Waterbody Assessments and Development the 2004 Integrated Report for Nebraska*, October 2003.

The details of the assessment process to determine the use support of the Primary Contact Recreation beneficial use can be found in table 2.1.3

2.1.4 Water Quality Conditions

E. coli data collected during the 2003 recreation season (May through September) was assessed to determine the beneficial use support for primary contact recreation. Table 2.1.4 presents this information.

Table 2.1.3 Assessment of the Primary Contact Recreation Beneficial Use Using Fecal Coliform and *E. coli* Bacteria Data.

Parameter	Season Geometric Mean	Single Sample Maximum	Supported	Impaired
Fecal coliform	≤200/100 ml	No more that 10% of Samples >400/100 ml	Season geometric mean ≤200/100 ml or ≤10% of samples exceed 400/100ml	Season geometric mean >200/100 ml and/or >10% of samples exceed 400/100ml
E. coli	≤126/100 ml	235-576/100 ml depending upon frequency of use	Season geometric mean ≤126/100 ml	Season geometric mean >126/100 ml

Table 2.1.4 Loup River Basin – 2003 *E. coli* Data and Assessments – Category 5 Waterbodies

Segment	Site Location	USGS/DNR Gage Associated with Site	Number of Samples	Season Geometric Mean (#/100 ml)
LO1-10000	Loup River at Columbus	Extrapolated using 06794000 and 06793000	22	576
LO1-30000	Loup River @ Fullerton	Extrapolation using 06792000, 06792500 and 06793000	22	189
LO1-30300	Cedar River @ Fullerton	06792000	22	444
LO2-10000	North Loup River @ St. Paul	06790500	22	195
LO2-11400	Calamus River @ Brewster	Extrapolated using 06787000	22	328
LO2-30000	North Loup River East of Brownlee	Extrapolated using 06786000	22	148
LO2-40000	North Loup River @ Brownlee	Extrapolated using 06786000	22	205
LO3-10000	Middle Loup River @ St. Paul	06785000	22	203
LO3-50300	Dismal River South of Mullen	Extrapolated using 06775900	22	246
LO4-10000	South Loup River @ St. Michael	06784000	22	329
LO4-20000	South Loup River @ Ravenna	Extrapolated using 06784000	22	392

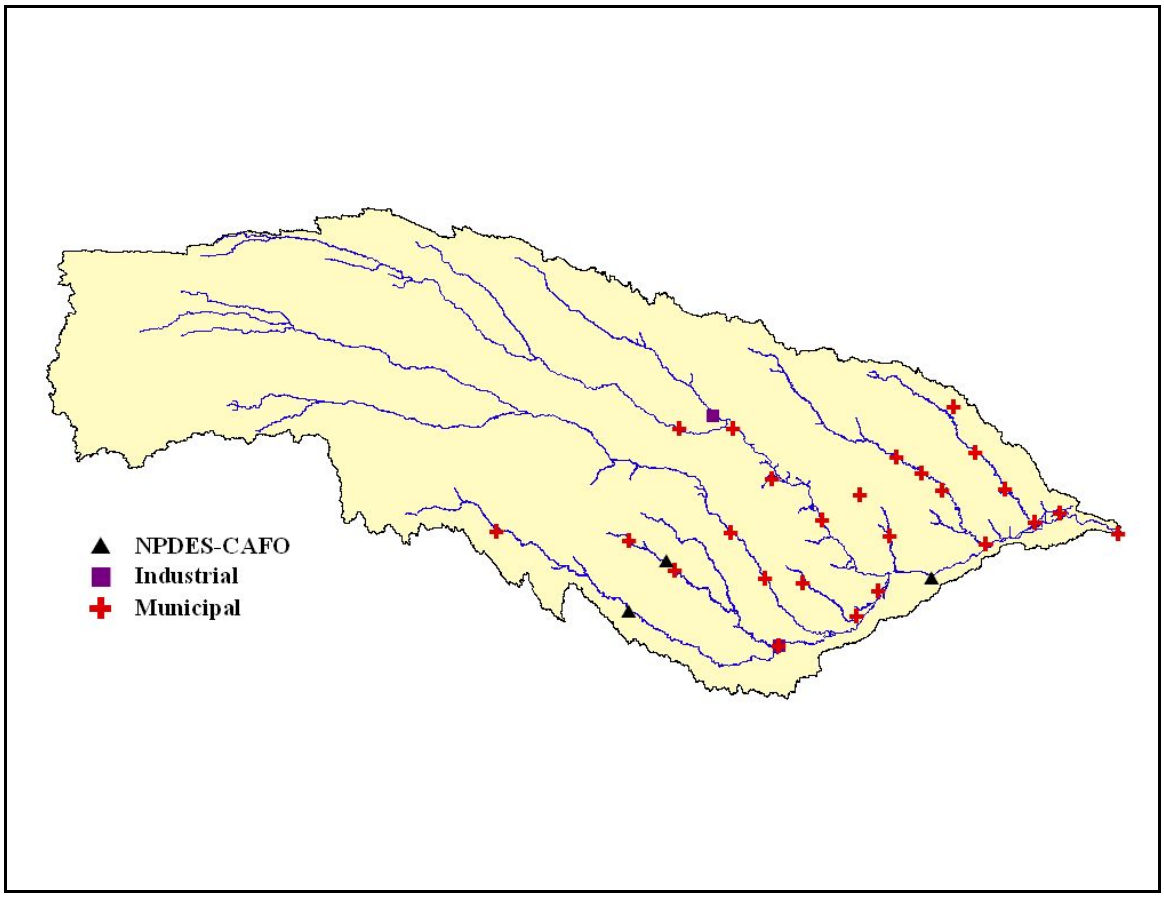
2.1.5 Potential Pollutant Sources

2.1.5.1 Point Sources: Point sources discharge or have the potential to discharge to waters in the Loup River Basin. Facility types include: municipal wastewater treatment facilities, industrial wastewater treatment facilities, a fish hatchery/rearing facilities and confined animal feeding operations. The facilities that have been issued a National Pollutant Discharge Elimination System Permit (according to EPA's Permit Compliance System) in the Loup River Basin are shown in Figure 2.1.5.1a.

Illicit connections, discharges, combined sewer overflows; sanitary sewer overflows, straight pipes from septic tanks or other on-site wastewater systems can also be sources of *E. coli* bacteria.

Animal feeding operations that have been issued State of Nebraska permits, required for construction and operation of livestock waste control facilities (LWCF) if the operation has discharged, or has the potential to discharge, livestock waste to waters of the State are also considered potential sources. Figure 2.1.5.1b shows the facilities within the Loup Basin that have been issued or requested a permit. These facilities are designed to contain any run-off that is generated by storm events that are less in intensity than the 25 year, 24-hour rainfall.

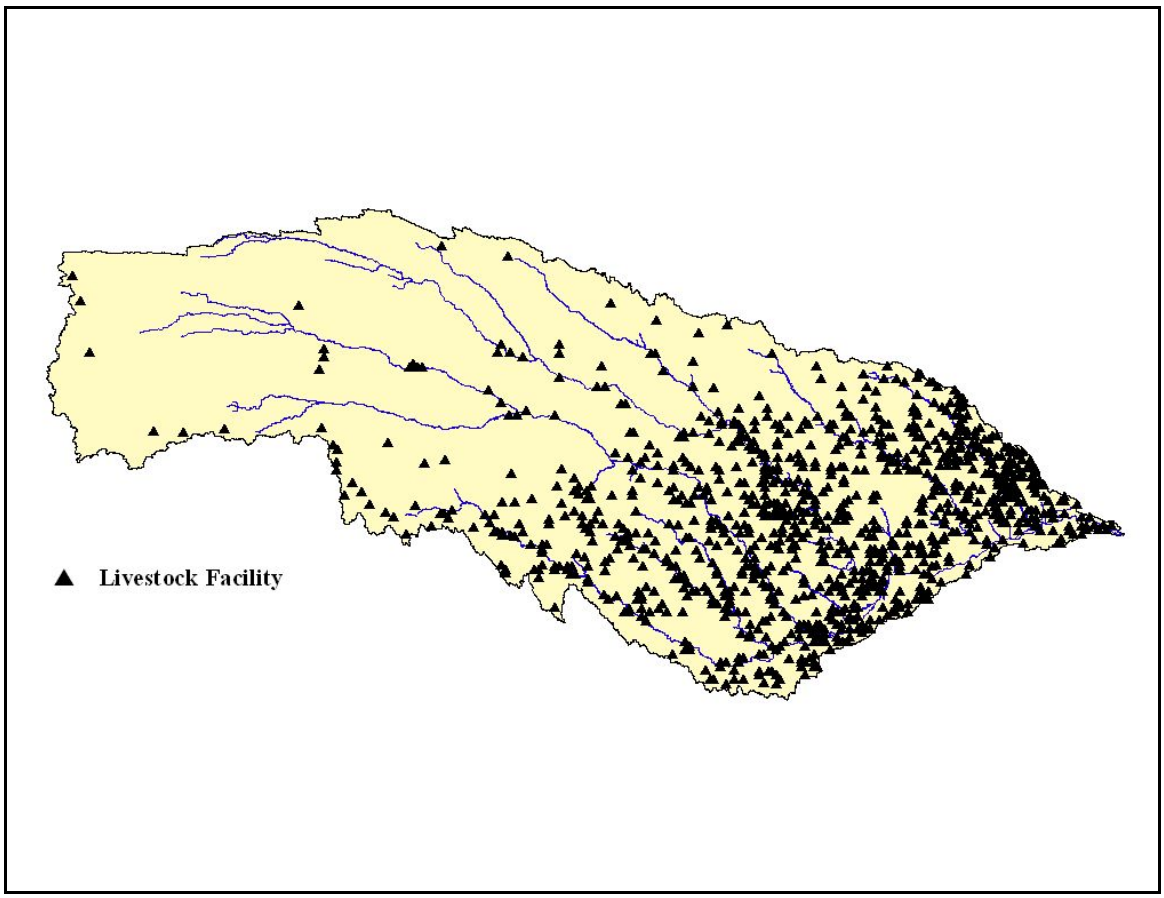
Figure 2.1.5.1a NPDES Permitted Facilities in the Loup River Basin



2.1.5.2 Nonpoint Sources: Several nonpoint sources of *E. coli* exist in the Loup River Basin. These sources include: failing septic tanks or other on-site wastewater systems, run-off from livestock pastures, improper or over-application of biosolids (wastewater treatment facility sludge, septage or manure) and urban stormwater runoff not regulated by an NPDES permit.

2.1.5.3 Natural Sources: The primary natural source of *E. coli* is wildlife. A variety of wildlife is native to or have adapted to the diverse habitat of the Loup River Basin. Big game, upland game, furbearers, waterfowl and non-game species have been documented to reside within the basin.

Figure 2.1.5.1b Animal Feeding Operations in the Loup River Basin Issued or Requesting a State Construction or Operating Permit or Requesting an Inspection



2.1 TMDL Endpoint

The endpoint for these TMDLs will be based on the numeric criteria associated with the Primary Contact Recreation beneficial use.

2.2.1 Numeric Water Quality Criteria

Water quality criteria established for the protection of the Primary Contact Recreation beneficial use can be found in Title 117, Chapter 4 and are as follows:

Fecal Coliform
Bacteria of the Fecal coliform group shall not exceed a geometric mean of 200/100 ml, nor exceed 400/100 ml, in more than 10% of the samples. These criteria are based upon a minimum of 5 samples taken within a 30-day period. This does not preclude fecal coliform limitations based on effluent guidelines.

These criteria apply during the recreational period of May 1 through September 30.

E. coli
E. coli bacteria shall not exceed a geometric mean of 126/100 ml. For increased confidence of the criteria, the geometric mean should be based on a minimum of five samples taken within a 30-day period. This does not preclude fecal coliform limitations based on effluent guidelines. Single sample minimum allowable densities shall not exceed the following criteria.

235/100 ml at designated bathing beaches
298/100 ml at moderately used recreational waters
406/100 ml at lightly used recreation al waters
576/100 ml at infrequently used recreational waters

The November 16, 2004 Federal Register (Volume 69, No. 220) contained information regarding the final rule for "Water Quality Standards for Costal and Great Lakes Recreational Waters". This rule includes a discussion on the use of the single season maximum (SSM). Specifically:

"EPA expects that the single season maximum values would be used for making beach notification and closure decisions. EPA recognizes however that States and Territories also use criteria in their water quality standards for other purposes under the Clean Water Act in order to protect and improve water quality. Other than in the beach notification and closure decision context, the geometric mean is the more relevant value for ensuring that appropriate actions are taken to protect and improve water quality because it is a more reliable measure, being less subject to random variation and more directly linked to the underlying studies on which the 1986 criteria were based.

Given this discussion and recommendation regarding the use of single season maximum in TMDLs and waterbody assessments, these TMDLs will focus on meeting the *E. coli* recreation season geometric mean of 126/100 ml.

2.2.2 Selection of Critical Environmental Conditions

The water quality criteria associated with the Primary Contact Recreation beneficial use only applies from May 1 through September 30. Therefore, the critical conditions for these TMDLs will be those occurring from May 1 through September 30.

2.2.3 Waterbody Pollutant Loading Capacity

Defining waterbody pollutant loading capacity implies a steady state. The TMDL recognizes loadings are dynamic and can vary with stream flow. As well, the above section indicates a wide range of environmental conditions that must be accounted for.

The method chosen to account for the variation in flow is based upon a load duration (TMDL) curve. TMDL curves are initiated by the development a stream's hydrograph using the long-term gage information. The flow information (curve) is then translated into a load curve by multiplying the flow values by the water quality standard (WQS) and a conversion factor (C). The acceptable "load" is then plotted graphically.

Therefore, the loading capacity for each of the segments will be defined by:

Loading capacity = WQS * Flow * C

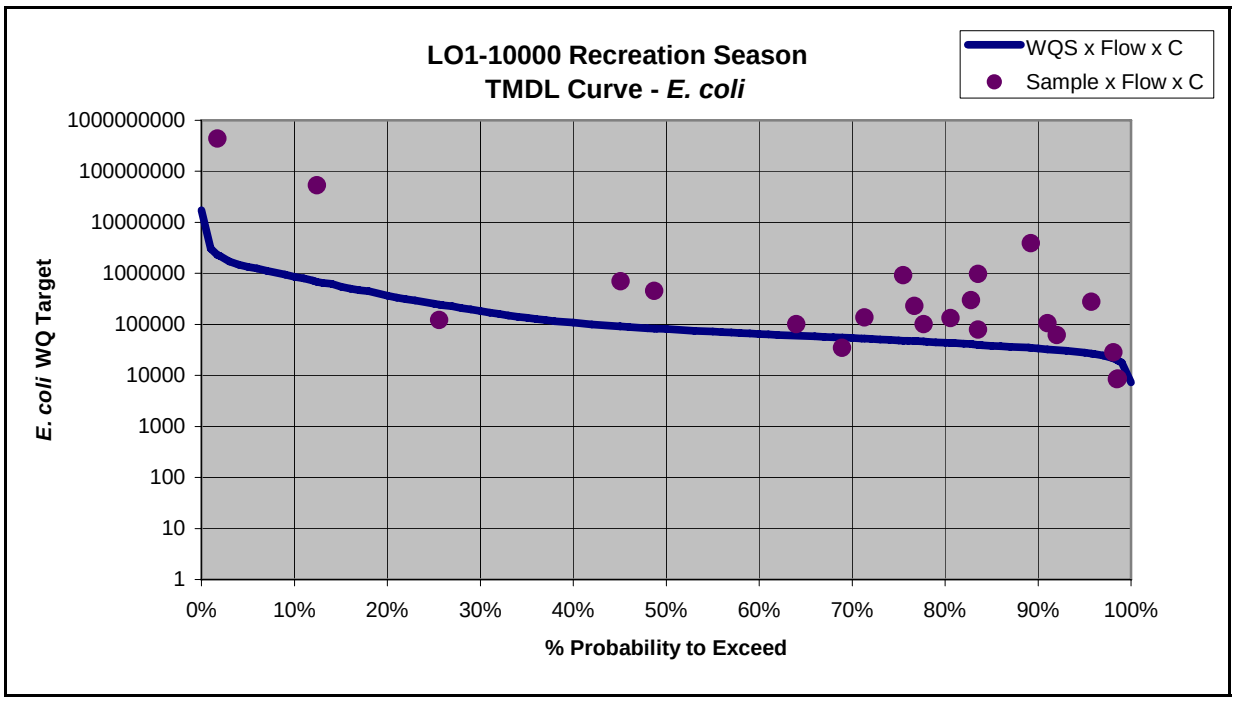
2.3 Pollutant Source Assessment

For these TMDLs the source loading is based upon the position of the monitoring data points in relation to the boundary established on the TMDL curve between point source and nonpoint source influences. This process for selecting the load point is described in the document entitled Nebraska's Approach for Developing TMDLs for Streams Using the Load Duration Curve Methodology (NDEQ 2002c). In the situation where a boundary has not been included on a TMDL curve, the information indicates no point source facilities discharge to the contributing watershed. For these waterbodies, the pollutant will be considered derived from nonpoint and natural sources.

2.3.1 Existing Pollutant Conditions

The existing pollutant conditions are shown in the TMDL curves (Figure 2.3.1a through 2.3.1k) provided for each of the segments where a TMDL is being developed. The points plotted above the acceptable loading indicate a deviance from the water quality criteria.

Figure 2.3.1a TMDL Curve for LO1-10000



2.3.2 Deviation from Acceptable Pollutant Loading Capacity

Table 2.3.2 describes the deviation from the acceptable water quality standards based upon the 2003 *E. coli* monitoring information.

Figure 2.3.1b TMDL Curve for LO3-30000

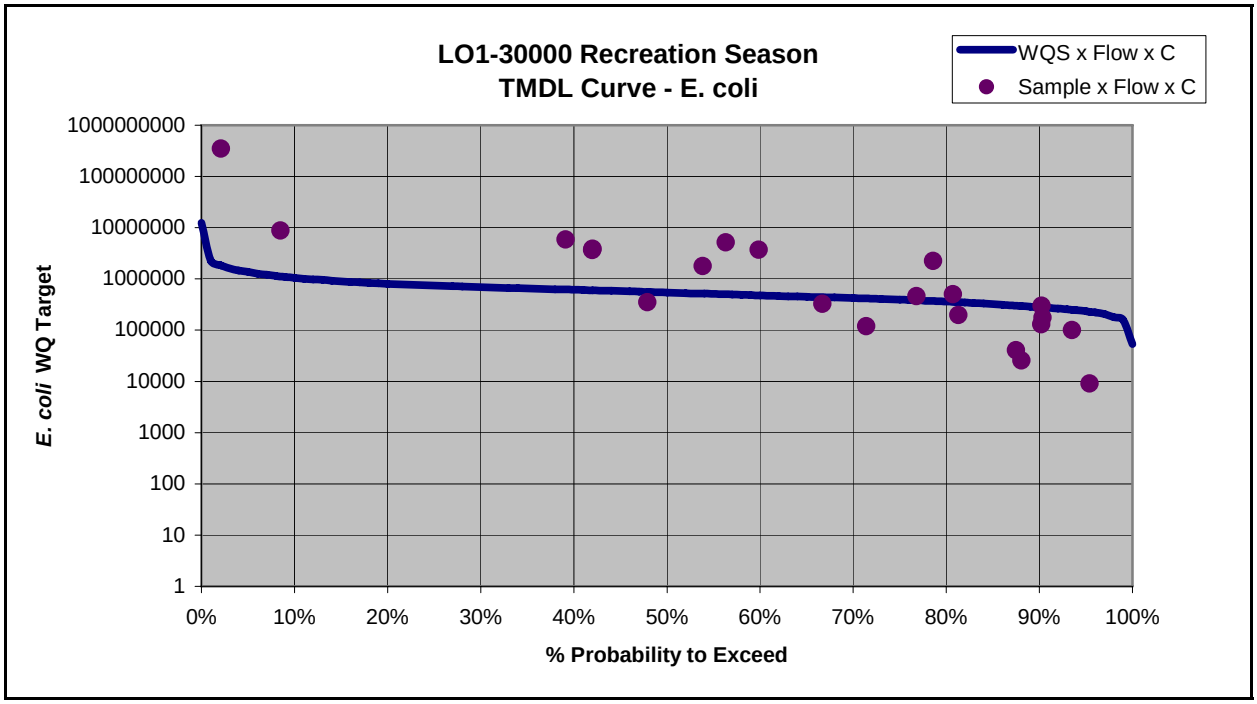


Figure 2.3.1c TMDL Curve for LO3-30300

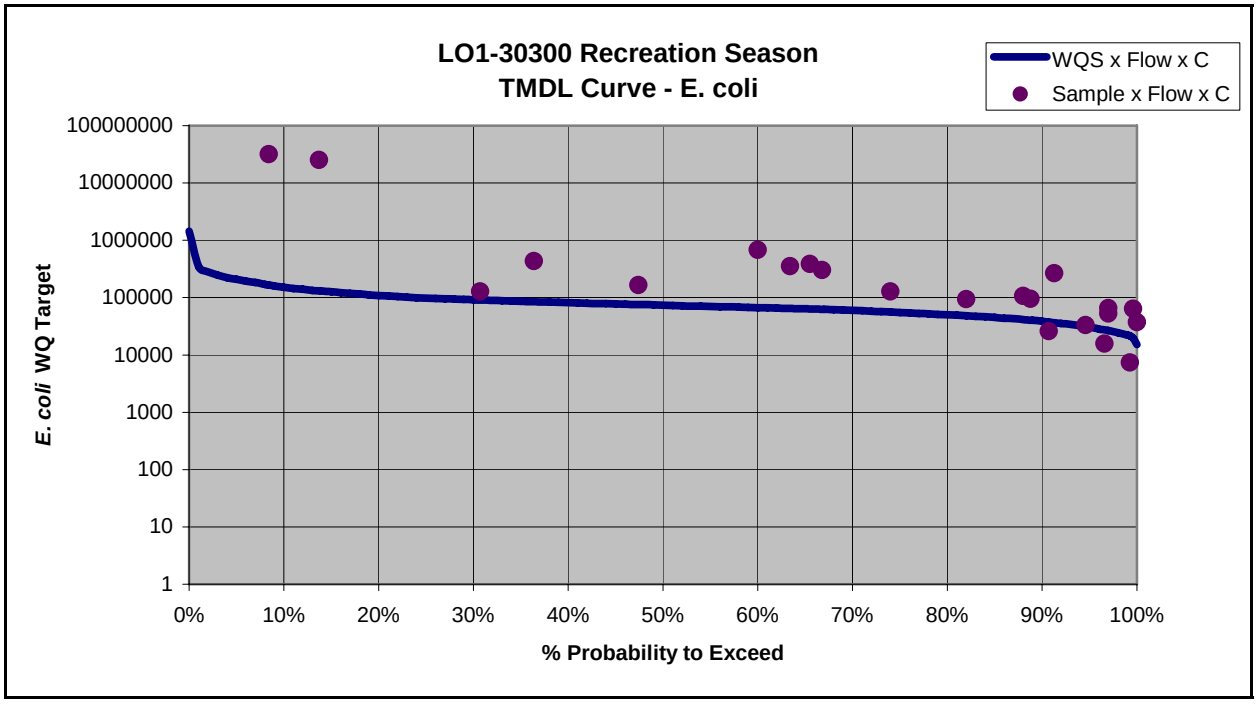


Figure 2.3.1d TMDL Curve for LO2-10000

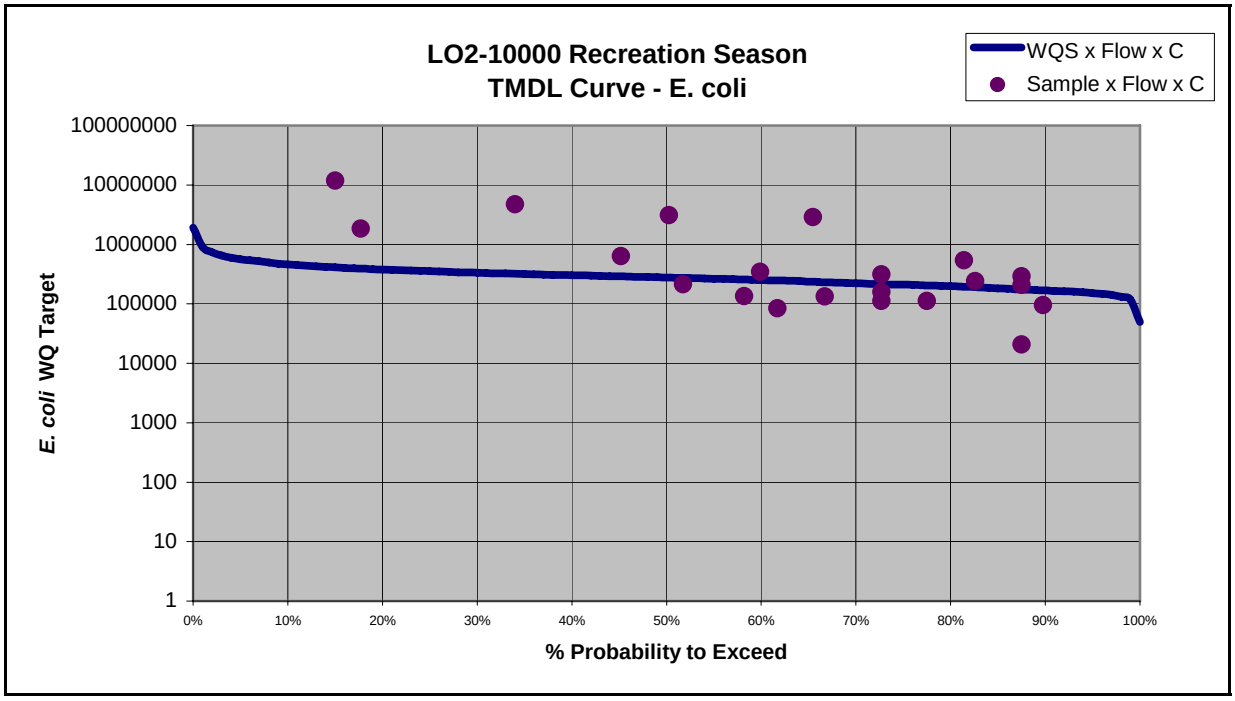


Figure 2.3.1e TMDL Curve for LO2-11400

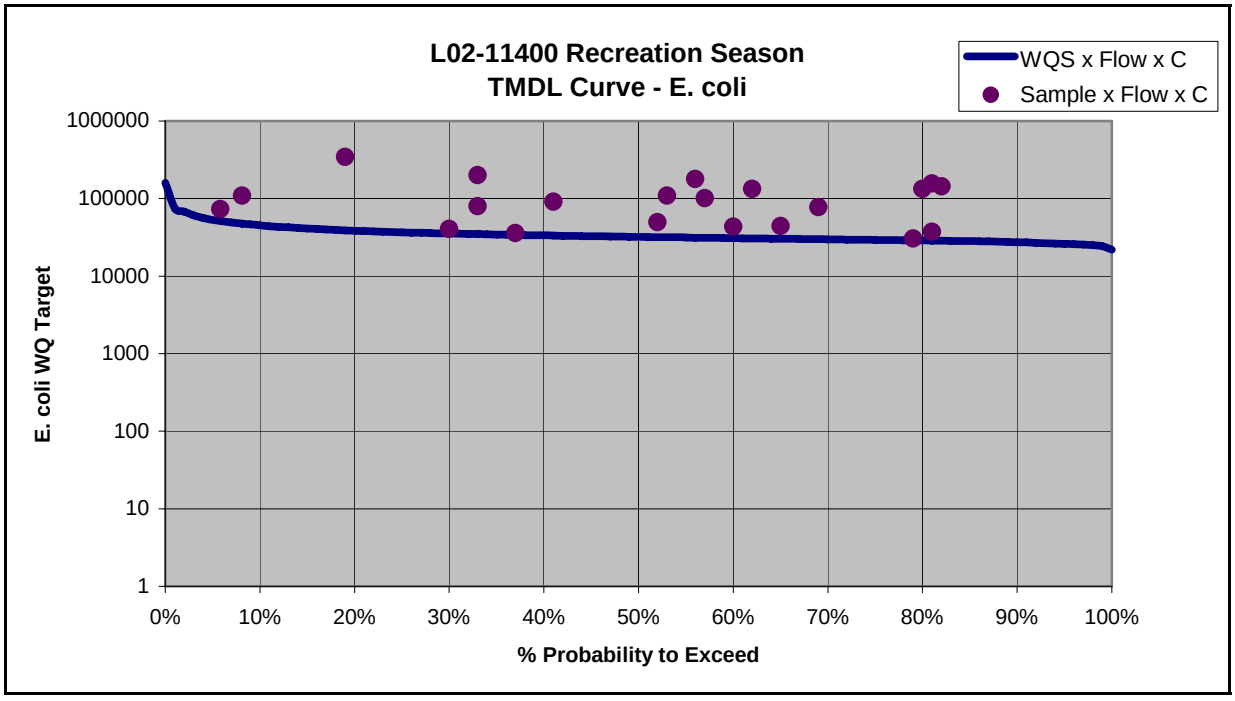


Figure 2.3.1f TMDL Curve for LO2-30000

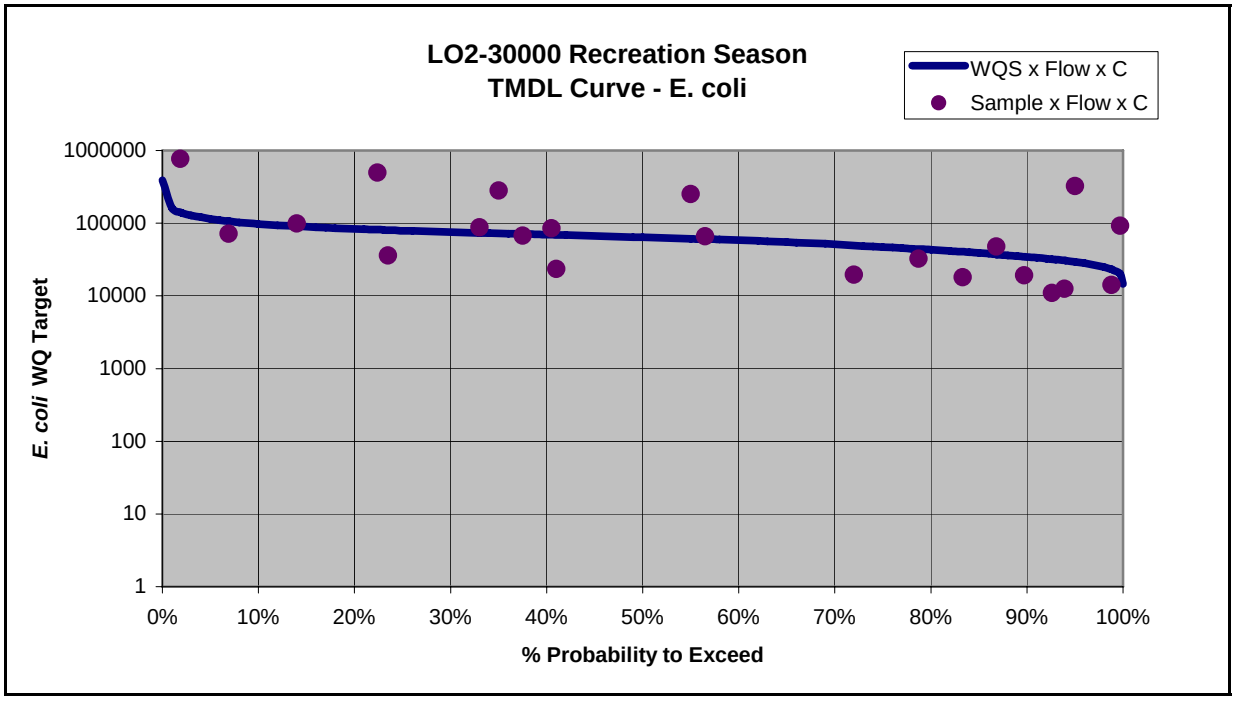


Figure 2.3.1g TMDL Curve for LO2-40000

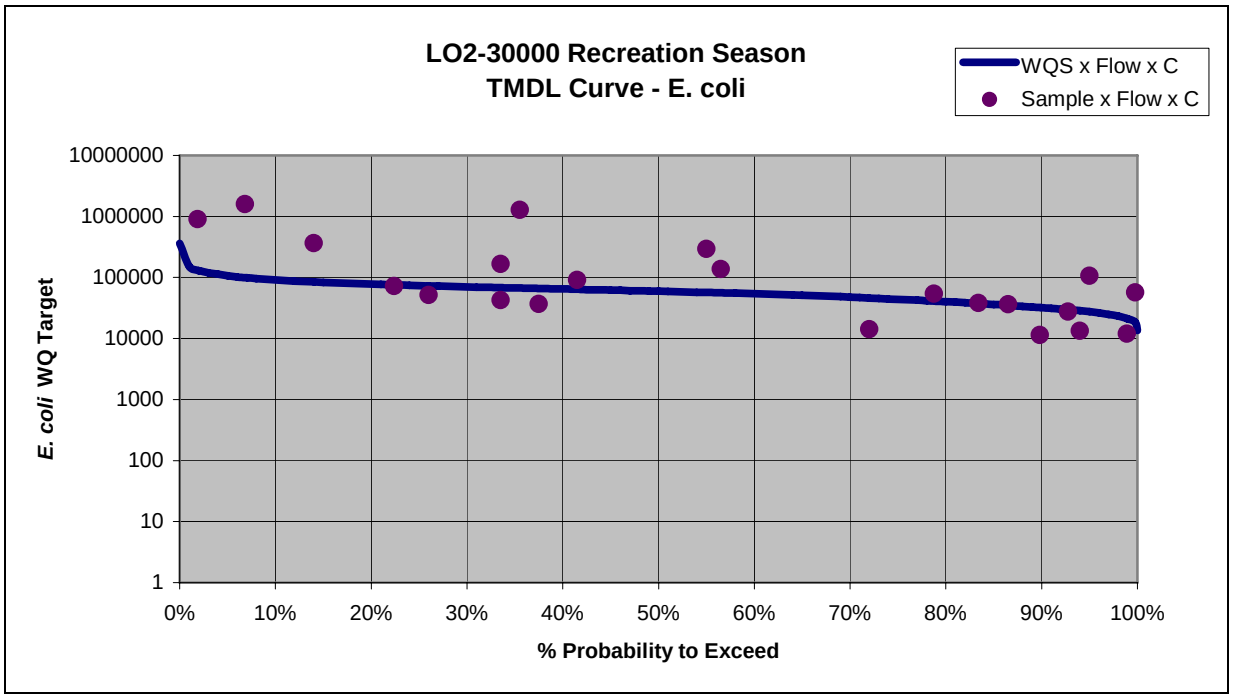


Figure 2.3.1h TMDL Curve for LO3-10000

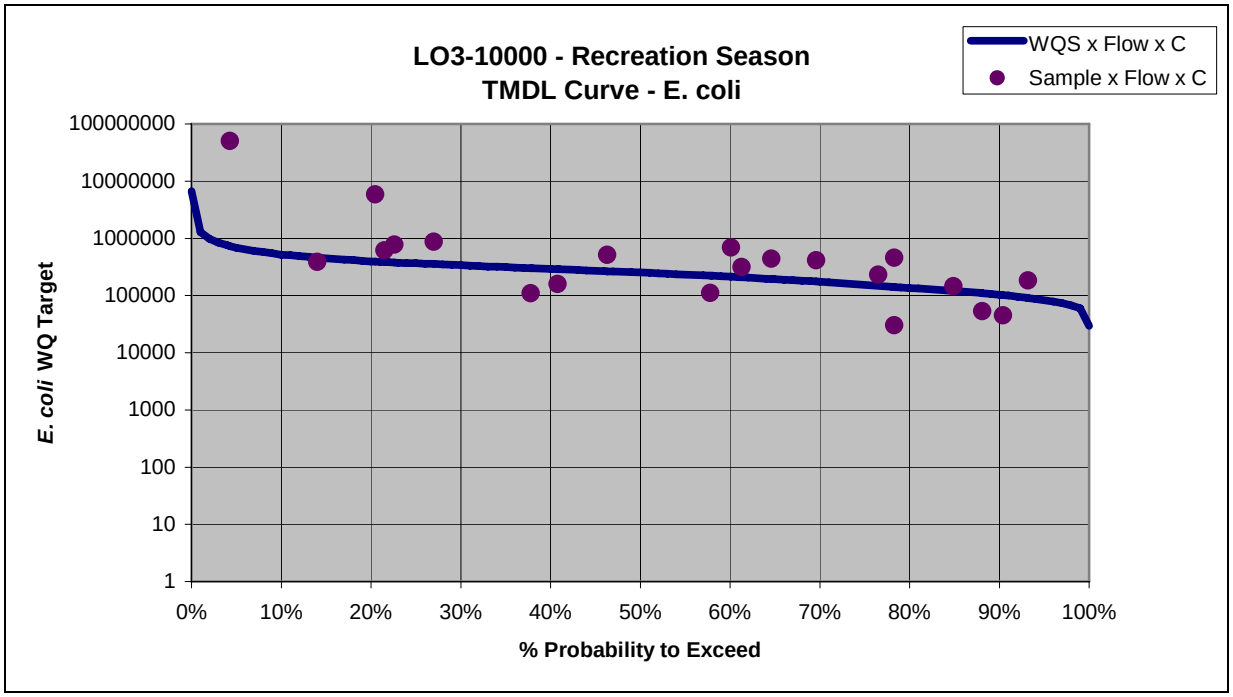


Figure 2.3.1i TMDL Curve for LO3-50300

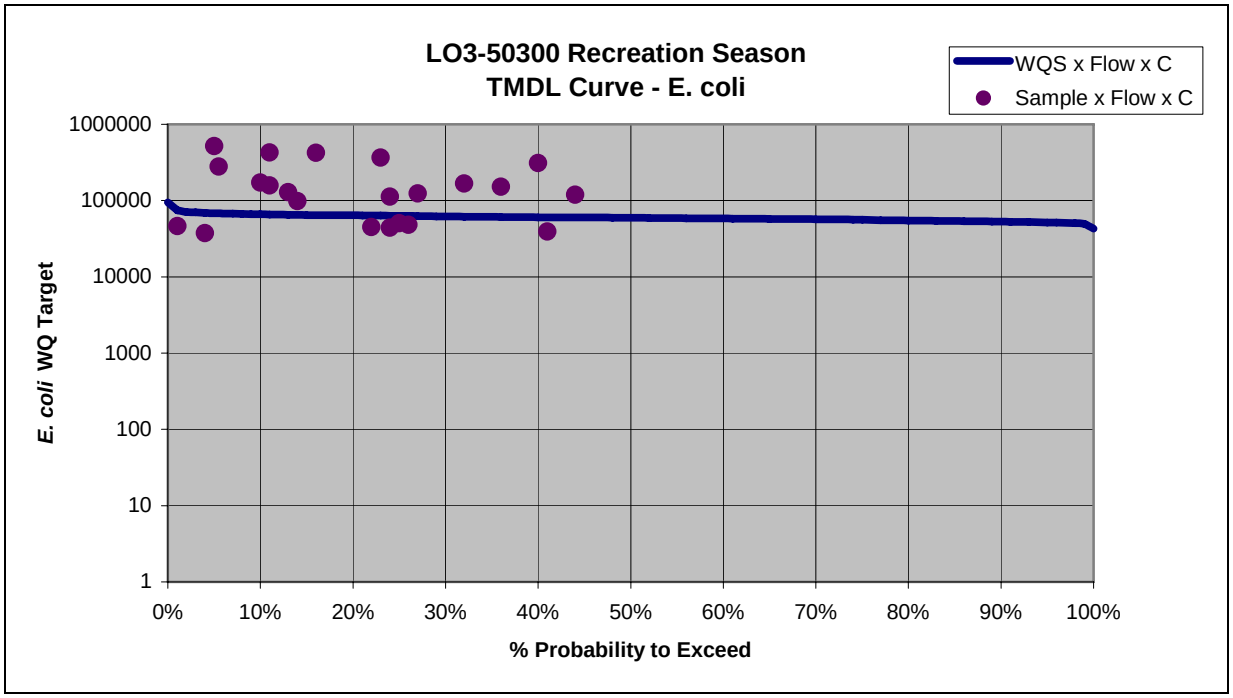


Figure 2.3.1j TMDL Curve for LO4-10000

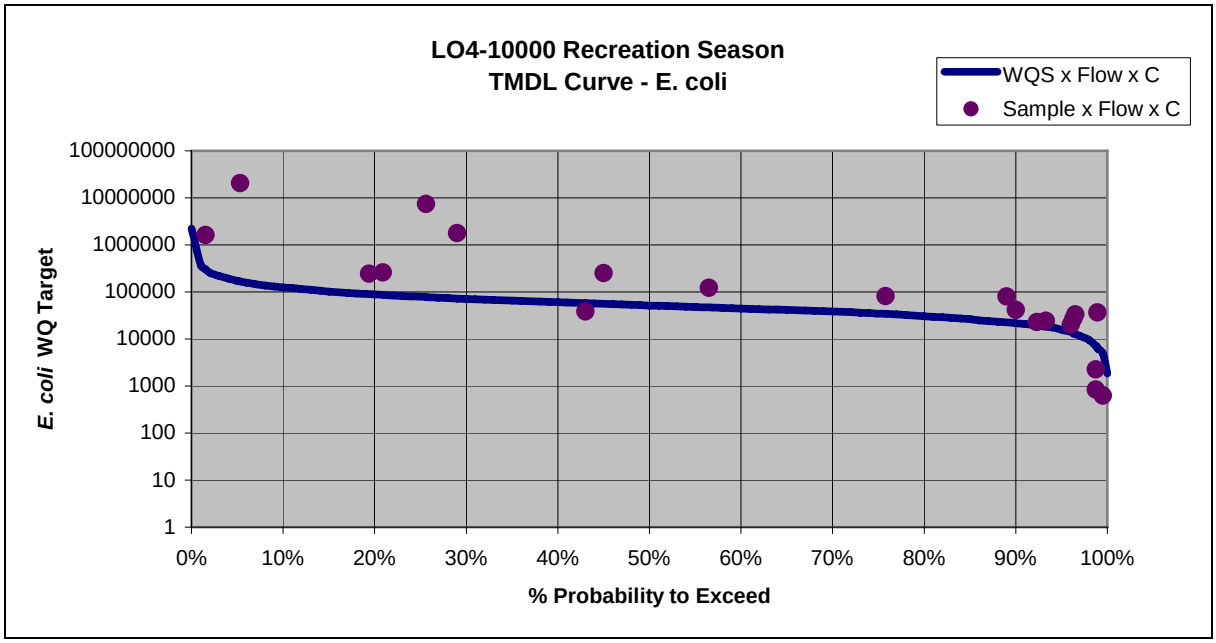


Figure 2.3.1k TMDL Curve for LO4-20000

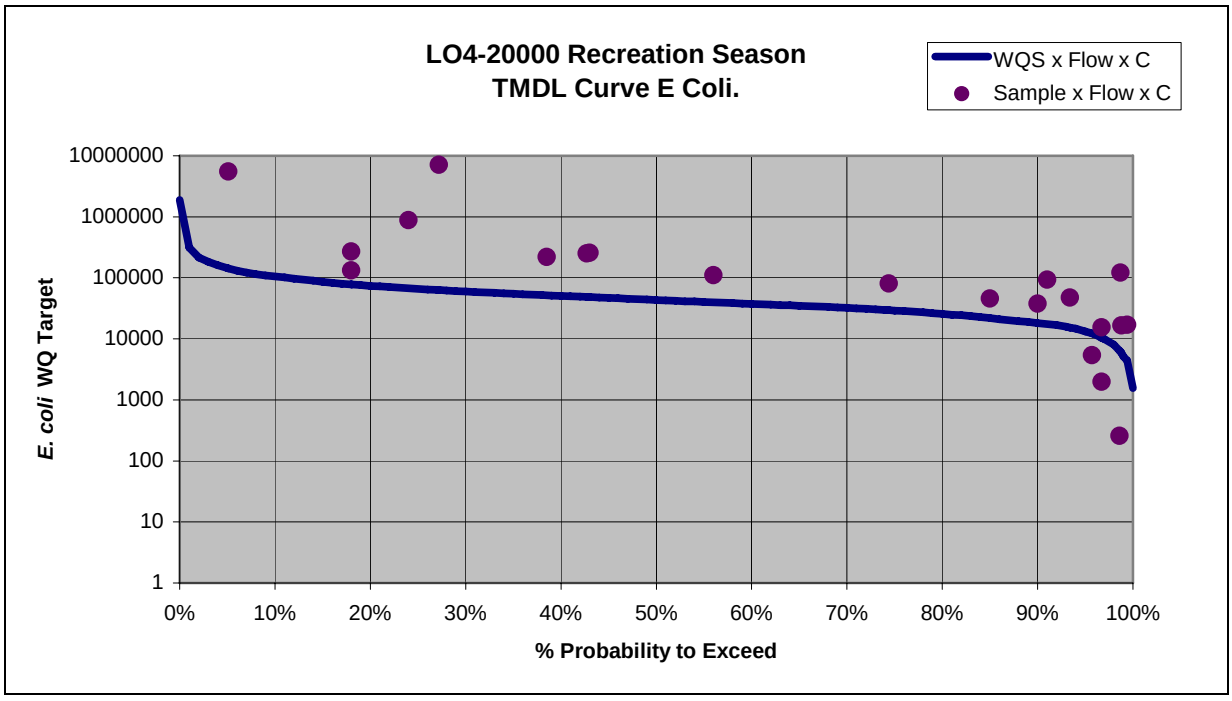


Table 2.3.2 Deviation From the Applicable Water Quality Criteria

Segment	Observed Season Geometric Mean (#/100 ml)	#/100 ml Above WQS
LO1-10000	576	450
LO1-30000	189	63
LO1-30300	444	318
LO2-10000	195	69
LO2-11400	328	202
LO2-30000	148	22
LO2-40000	205	57
LO3-10000	203	77
LO3-50300	246	121
LO4-10000	329	203
LO4-20000	392	266

2.3.3 Identification of Pollutant Sources

Both point and nonpoint sources are known to exist along some of the segments and within the contributing watersheds. Due to the size of the watersheds, the somewhat limited data, the delivery methods and the location of the potential sources in relation to the impaired waterbody; it is difficult to definitively identify specific sources. It is important to note that all potential sources may not contribute to the water quality impairments and some sources may contribute at a greater degree than others.

The method utilized to determine the contributions of the sources will be based upon a demarcation where point source discharges are not expected to further impact the waterbody. That is, based on the concept of a continuous and relatively constant effluent volume, a dilution or flow value can be determined where point sources are no longer expected to contribute to water quality excursions. The process is explained in the document entitled Nebraska's Approach for Developing TMDLs for Streams Using the Load Duration Curve Methodology.

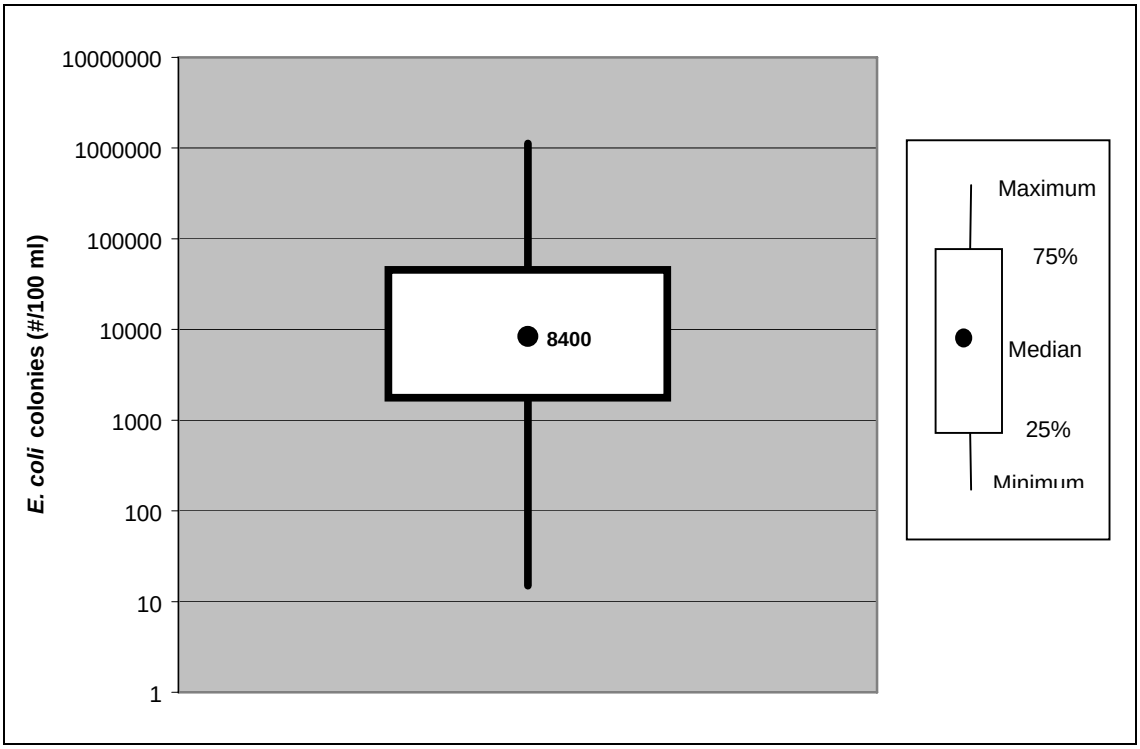
E. coli concentrations in wastewater can vary greatly, depending upon treatment technology, wastewater strength, industrial contributions, treatment efficiency and season. The selection of an all-encompassing effluent density value must then account for these and other variables. To that end, the NDEQ has collected effluent *E. coli* information from several facilities not providing disinfection of the wastewater discharge. The data was obtained from 24 facilities that include both mechanical and lagoon facilities and as seen in Figure 2.3.3a, exhibits a normal distribution. The median value was selected as the input for the "expected pollutant concentration". The equation to determine the point source/nonpoint source boundary then becomes:

$$Q_s = (8{,}400/100 \text{ ml} * \Sigma Q_e)/126/100 \text{ ml}$$

Where:

Q_s	= stream flow volume necessary to meet water quality standards
8,400/100 ml	= expected *E. coli* coliform density from point sources
ΣQ_e	= sum of **all** design flows from point sources discharging to the segment (direct or via tributaries)
126/100 ml	= water quality standard

Figure 2.3.3a. *E. coli* Data from 24 Wastewater Treatment Facilities



The values for ΣQ_e can be found in Table 2.3.3 as can the boundary flows.

Table 2.3.3 Sum of Wastewater Treatment Facility Design Flows in the Loup Basin

Segment	Total Number of Facilities	Sum of Contributing Facility Design Flows	Flow Value for Point vs. Nonpoint Boundary
LO1-10000	6	7.83 cfs	522 cfs
LO1-30000	2	0.16 cfs	486 cfs*
LO1-30300	4	1.42 cfs	94 cfs
LO2-10000	3	1.39 cfs	319 cfs*
LO2-11400	0		
LO2-30000	0		
LO2-40000	0		
LO3-10000	4	1.83 cfs	191 cfs*
LO3-50300	0		
LO4-10000	1	0.2 cfs	24 cfs*
LO4-20000	0		

*Recreation Season 7q10 value

The identification of pollutant sources and impacts are shown in figures 2.3.3b through 2.3.3.d. Pollutant source chart/curve were not provided for segments LO2-11400, L02-30000, LO2-40000, LO3-50300 and LO4-20000 based upon no point source discharging to these segment**.** As well, pollutant source TMDL charts/curves were not provided for LO1-30000 LO2-10000 and LO3-10000, as the boundary flows were <1st percentile flow and no data points fell in this range. The absence of exceedances at these flows indicates nonpoint source influences.

Figure 2.3.3b. Identification of Pollutant Sources Using the TMDL Curve for LO1-10000

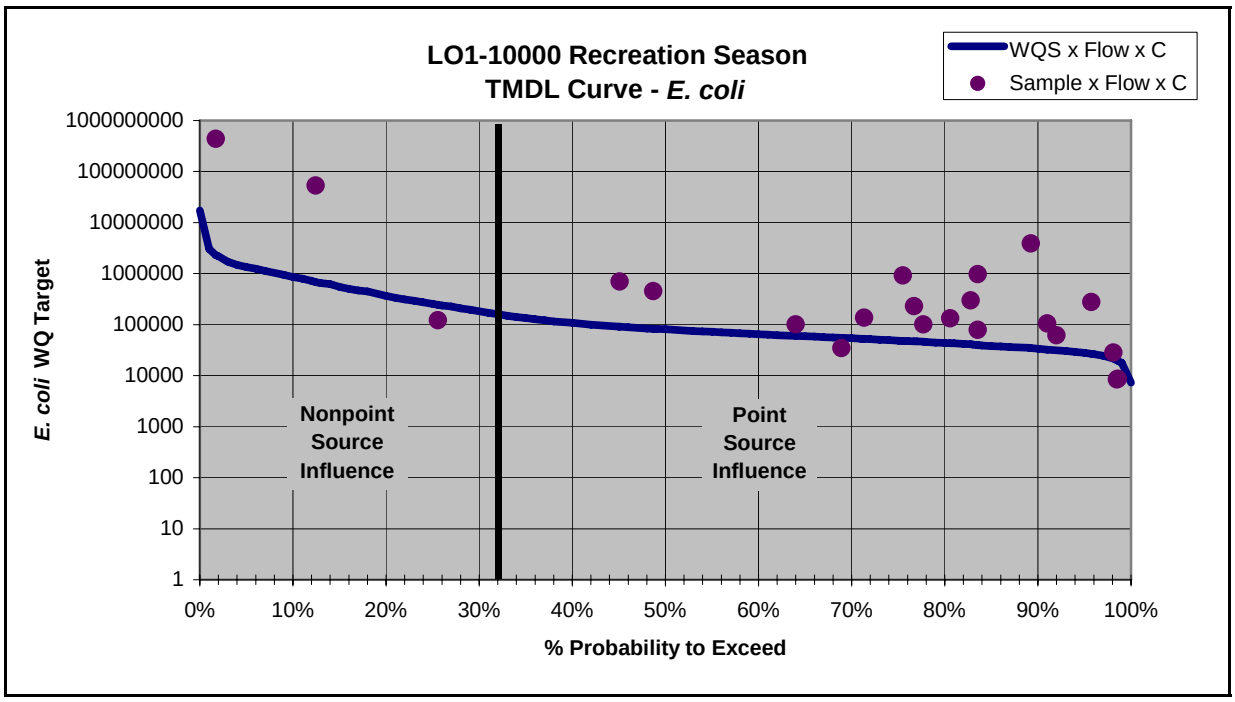


Figure 2.3.3c. Identification of Pollutant Sources Using the TMDL Curve for LO1-30300

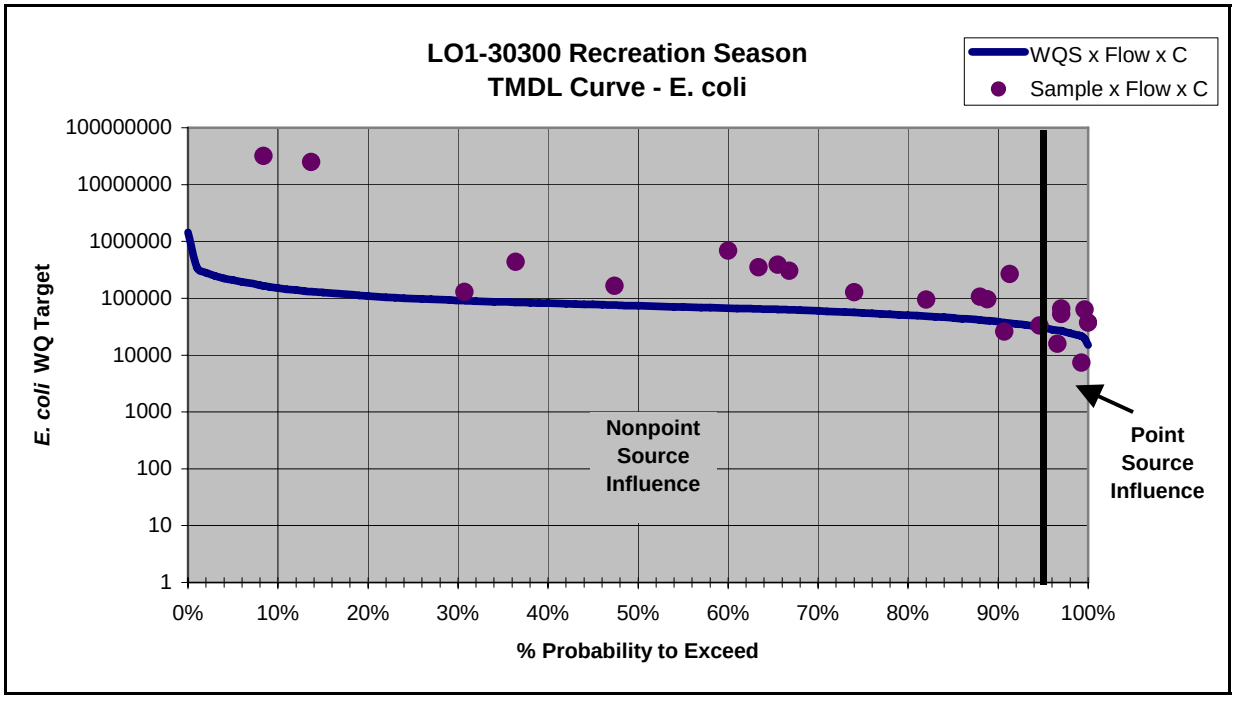
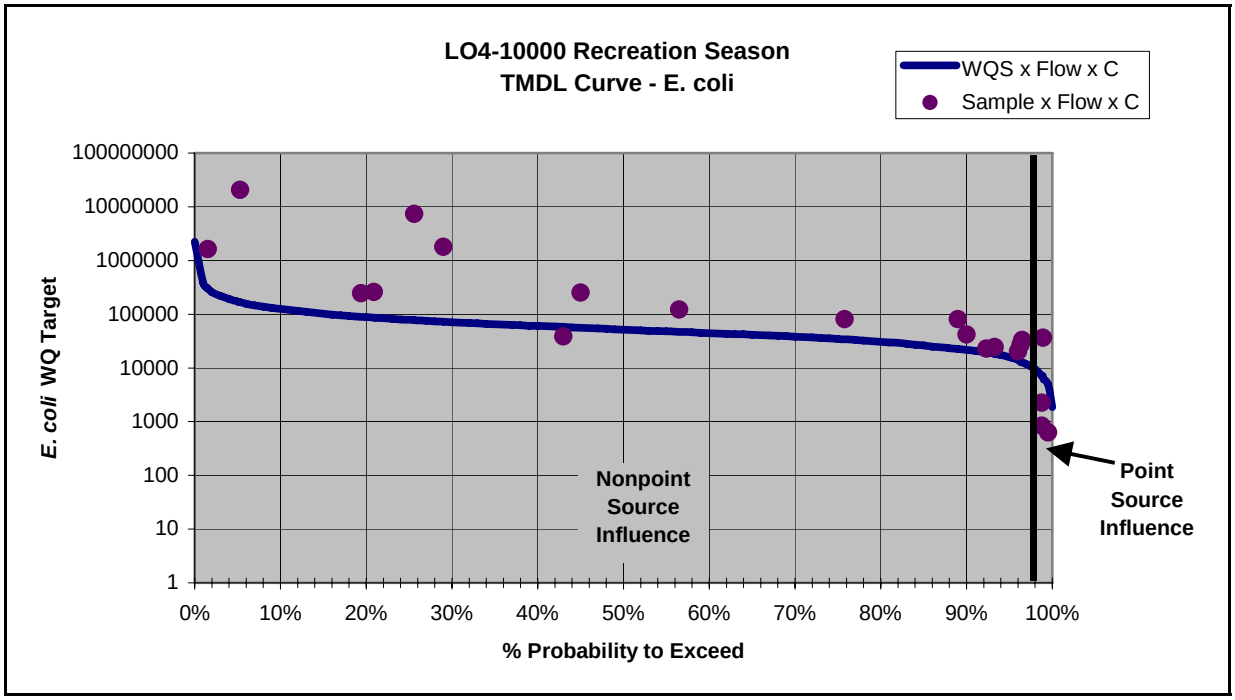


Figure 2.3.3d. Identification of Pollutant Sources Using the TMDL Curve for LO4-1000



2.3.3.1 Point Sources of *E. coli*: Based upon the TMDL curves and the position of the monitoring data points it appears point sources are contributing to the *E. coli* impairment within segments LO1-10000, LO1-30300 and LO4-10000. The facilities that discharge either directly to or into a tributary of the Loup River recreation segments and are listed in Table 2.3.3.1.

2.3.3.2 Nonpoint and Natural Sources of *E. coli*: Due to the diverse nature, distribution and delivery method, nonpoint and natural sources will not be separated. Therefore, the monitoring data that fall to the left of the boundary are considered to be the result of nonpoint and natural background sources.

The source identification process utilized was done so in order to get a general idea of the source category. This simplified numeric process should not be considered exclusive as an overlap of source contributions is recognized during periods where run-off is contributing to stream volume. In the future, expanded sampling may target specific source identification. Future monitoring and assessment will also take into account the controls (i.e. wastewater disinfection) that have been instituted. When considered, the demarcation may fluctuate and the source contributions re-evaluated.

2.4 Pollutant Allocation

A TMDL is defined as:

$$\text{TMDL} = \text{Loading Capacity} = \text{WLA} + \text{LA} + \text{Background} + \text{MOS}$$

Where:

Flow = Stream flow volume (cubic feet per second)
126/100 ml = applicable/target water quality criteria for *E. coli* from Title 117
C = conversion factor.

Table 2.3.3.1 NPDES Permitted Discharges to Loup River Basin Impaired Segments

Downstream Recreation water	Receiving Water	Facility	NPDES Permit Number	Facility Design Flow - cfs	Facility Discharge Directly to Recreation Segment?	Approximate Distance to Recreation Segment (stream miles)	Fecal coliform Limits in NPDES Permit?
LO1-10000	LO1-10000	Columbus WWTF	NE0035025	6.96	**Yes**		Yes
	LO1-10300	Monroe WWTF	NE0046221	0.05	No	1.6	Yes
	LO1-10600	Genoa WWTF	NE0027341	0.16	No	3.5	No
	LO1-10700	Albion WWTF	NE0026573	0.32	No	37.1	No
	LO1-10700	St Edward WWTF	NE0027332	0.26	No	20.5	Yes
	Undesignated Tributary to LO1-10800	Petersburg WWTF	NE0029157	0.06	No	53.6	No
LO1-30000	LO1-30700	Wolbach WWTF	NE0040088	0.05	No	14.9	No
	LO1-30800	Greeley WWTF	NE0049212	0.11	No	33.1	No
LO1-30300	LO1-30300	Cedar Rapids WWTF	NE0049158	0.27	**Yes**		Yes
	LO1-30300	Fullerton WWTF	NE0026638	0.36	**Yes**		**No**
	LO1-30300	Primrose WWTF	NE0029220	0.02	**Yes**		Yes
	LO1-30300	Spalding WWTF	NE0112909	0.77	**Yes**		Yes
LO2-10000	LO2-10000	Burwell WWTF	NE0021172	0.62	**Yes**		Yes
	LO2-10000	Ord WWTF	NE0024392	0.50	**Yes**		Yes
LO2-10000	LO2-10000	Scotia WWTF	NE0023973	0.27	**Yes**		Yes
LO2-11300	LO2-11300	NGPC - Calamus Fish Hatchery	NE0124745	9.28	**Yes**		**No**
LO2-20000	LO2-20000	Taylor WWTF	NE0113000	0.63	**Yes**		Yes
LO3-10000	LO3-10000	Loup City WWTF	NE0045250	0.56	**Yes**		Yes
	LO3-10000	St. Paul WWTF	NE0027324	0.51	**Yes**		Yes
	LO3-10300	Dannebrog WWTF	NE0045136	0.68	No	2.7	No
	LO3-10400	Ashton WWTF	NE0024350	0.08	No	27.4	No
LO3-30000	LO3-30000	Arcadia WWTF	NE0041297	0.06	**Yes**		Yes
LO4-10000	LO4-10000	Ravenna WWTF	NE0021547	0.20	**Yes**		Yes
LO4-10200	LO4-10200	Ansley WWTF	NE0043249	0.08	**Yes**		**No**
	LO4-10200	Broken bow WWTF	NE0027260	1.02	**Yes**		Yes
LO4-30000	LO4-30000	Arnold WWTF	NE0028096	0.13	**Yes**		Yes

By regulation, a TMDL requires a loading capacity value for the pollutant of concern. In the case of *E. coli*, a "load" (flow rate x concentration x time) could be calculated, but the approach may not be appropriate for expressing this non-conservative parameter. Therefore, for the purposes of these TMDLs, a loading capacity will not be "calculated" but will be expressed as the water quality standard. Because the water quality is expressed as a concentration, the LC will not equal the WLA + the LA.

To achieve the desired loading capacities requires the following allocations

2.4.1 Wasteload Allocations

2.4.1.1 NPDES Permitted Facilities: Title 117 does not allow for the application of a mixing zone for the initial assimilation of effluents in order to meet the criteria associated with the recreation beneficial use. Because of this, the water quality criteria are applied to the "end-of-pipe" concentrations and are applicable at all stream flows >7q10. Therefore, the *E. coli* wasteload allocation established by this TMDL will be a monthly geometric mean 126/100 ml.

The wasteload allocation will initially be applied to all facilities that discharge directly to a recreational segment. Future monitoring and evaluation will be utilized to determine if *E. coli* limitations are necessary for facilities discharging to the recreation segment's tributaries.

2.4.1.2 Dry Weather Discharges: Dry weather discharges can either be from illicit sources, cross-connections or mechanical failure and often exhibit the greatest influence on the base flow conditions of the stream. Thus, it is most appropriate to group these discharges and limit similarly to the WWTFs. Specifically, the wasteload allocations assigned to these discharges shall be a seasonal geometric mean of 126/100 ml.

2.1.4.3 Non-Discharging Facilities: Several facilities including confined animal feeding operations and lagoons are designed for "zero" discharge. In the case of animal feeding operations, discharges may only occur as the result of a 25 year 24 hour storm event or a chronic wet period with an accumulative precipitation equivalent to a 25 year 24 hour storm. Based on this permitting provision, the WLA for facilities classified as non-discharging will be zero (0).

2.4.2 Load Allocations

The load allocations assigned to these TMDLs will be based upon the stream flow volume and will be defined as:

$$LA_i = Q_i * 126/100 \text{ ml} * C$$

Where:
LA_i = load allocations at the i^{th} flow
Q_i = stream flow at the i^{th} flow
126/100 ml = applicable/target water quality criteria for *E. coli* from Title 117
C = conversion factor

2.4.2.1 Load Reduction to Meet Water Quality Criteria: It is important to report the reductions necessary to meet the water quality criteria. The necessary reductions were determined based upon the 2003 data, which is considered representative information. The targeted reductions found in Table 2.4.2.1 provide water quality managers with a quantitative endpoint by which implementation planning can be carried out. The noted reductions along including the application of point source controls if achieved should result in the waterbodies fully supporting the primary contact recreation beneficial use. The reductions stated in the table also include the margin of safety described below.

Table 2.4.2.1 Targeted Reductions to Meet Water Quality Criteria

Segment	Targeted Reduction	Expected Season Geometric Mean
LO1-10000	81%	109/100 ml
LO1-30000	42%	110/100 ml
LO1-30300	75%	111/100 ml
LO2-10000	44%	109/100 ml
LO2-11400	67%	108/100 ml
LO2-30000	26%	110/100ml
LO2-40000	46%	110/100 ml
LO3-10000	46%	109/100 ml
LO3-50300	57%	106/100 ml
LO4-10000	66%	112/100 ml
LO4-20000	72%	110/100 ml

2.4.3 Margin of Safety

A margin of safety (MOS) must be incorporated into TMDLs in an attempt to account for uncertainty in the data, analysis or targeted allocations. The MOS can either be explicit or implicit and for these TMDLs are as follows:

- To account for uncertainty in the nonpoint source load reduction, the targeted reductions will be set at 90% of the water quality target (126/100 ml). Specifically the reductions shall be applied to meet a seasonal geometric mean of ≤113/100 ml.
- Decay and/or die off of *E. coli* were not accounted for in either the source assessment or in establishment of the load reduction. That is, the entire concentration/load from the source was assumed to be present within the waterbody and the reductions should focus on the load.
- These TMDLs assumed the effluents discharge the *E. coli* density allowed by the WLA or 126/100 ml. WWTF disinfection systems are often designed and operated to achieve 100% reduction in the indicator bacteria or 0/100ml. Thus, the actual NPDES permitted point source contribution is likely less than expected by the TMDL.

3.0 Implementation Plan

The implementation of controls to manage *E. coli* within the Loup River Basin includes but is not limited to:

3.1 NPDES Permitted Point Sources

Limitations are established in NPDES permits in accordance with Title 119 – Rules and Regulations Pertaining to the Issuance of Permits Under the National Pollutant Discharge Elimination System (Title 119), Title 119 Chapter 27 states:

Chapter 27- EFFLUENT GUIDELINES AND STANDARDS

002 Test Procedures for analysis of pollutants. The conditions and requirements of 40 CFR Part 136 pertaining to the Guidelines Establishing Test Procedures for the Analysis of Pollutants are hereby adopted and incorporated by this reference.

Based upon this requirement, all samples used to demonstrate permit compliance (sampling method, transport holding, and analysis) must be in accordance with the procedures established in 40 CFR Part 136. At this time, there is no analytical procedure for *E. coli* included in Part 136. It is for this reason; fecal coliform remains in Title 117 as indicator bacteria for primary contact recreation. Although not as reliable as *E. coli*, fecal coliform should continue to be used in the NPDES permitting process. End-of-pipe limits will be set at a monthly geometric mean of 200/100 ml and a daily maximum of 400/100 ml. Compliance with these values will be considered functionally equivalent to meeting the water quality criteria for *E. coli*.

Facilities that discharge directly to all segments within the Loup River basin designated with the primary contact recreation use will be required to meet the wasteload allocations – applied as a fecal coliform limit - at the end of the pipe. Facilities discharging to tributaries will be evaluated to determine the extent of the effluent's impact on the recreation segment. If deemed significant, a request will be made to limit the fecal coliform concentration discharged from these facilities in the NPDES permit.

In addition to the permits, in the course of compliance audits, deficiencies in the operation of the WWTF disinfection appurtenances and noncompliance with the NPDES permit limits should be noted and corrective action pursued.

Biosolids (sludge) generated by municipal and industrial facilities are regulated under 40 CFR Part 257 and 40 CFR Part 503, respectively. 40 CFR part 257 requires that facilities and practices not cause nonpoint source pollution of waters of the United States. Part 503 specifically requires that sludge applications be not less that 10 meters from waters of the United States and that the sludge not be applied to frozen, flooded or snow covered ground if the sludge can enter into waters of the United States.

Consistent with Section 3.4 below, a recommendation will be made that all NPDES permittees be required to adhere to items #1and #2 for land application activities taking place either during or 10 days prior to the recreation season (May 1 – September 30). In those areas where land slope or drainage is such where the application has a greater potential to run-off, or where application has been observed to have run-off, the recommendation will be consistent with #3

3.2 NPDES Storm Water Discharges

The WLA defined in section 2.4.1.1 will be applicable to all NPDES discharges including discharge from regulated stormwater outfall. The NDEQ is responsible for determining the applicability of NPDES stormwater permits for urbanized areas with populations >10,000 but <100,000. As well, other municipal or construction areas can be designated for coverage under an NPDES (stormwater) permit if the NDEQ determines control of the stormwater is necessary.

Facilities discharging stormwater under the authority of a NPDES permit are required to implement the following minimum control measures:

- Implement a public education and outreach program on stormwater impacts
- Comply with State and local public notice requirements when implementing a public participation program.
- Develop and enforce a program to detect and eliminate illicit discharges.
- Develop, implement and enforce a program to reduce pollutants from construction activities.
- Develop, implement and enforce a program to reduce pollutants from post construction activities in new or redevelopment projects
- Develop a pollution prevention/good housekeeping program.

Rather than apply numeric limitations on individual stormwater outfalls, the strategy will be to initially allow the municipalities sufficient opportunity to comply with the NPDES requirements; either voluntarily or under the authority of an NPDES permit. In the future, should additional monitoring data indicate the minimum control measures are inadequate or have not been incorporated; consideration will be given to application of wasteload allocations for the outfalls in the area of concern.

At this time no MS4 permits have been issued to municipalities residing in the Loup River Basin. The issuance of future permits will likely be contingent upon the collection of additional data, the future beneficial use status of the impaired segments and the voluntary actions the candidate facilities have taken to minimize pollutants in the stormwater discharges.

3.3 Dry Weather Discharges

Title 119, Chapter 2 states:

> *002 All persons discharging or proposing to discharge pollutants from a point source into any waters of the State are required to apply for and have a permit to discharge.*

Discharges not permitted should be required to obtain the proper authorization to discharge. All discharges are then subject to the appropriate limitations consistent with the WLAs established by this TMDL. Elimination of the discharge should be undertaken in the event permitting and control is not feasible.

3.4 Animal Feeding Operations

Title 130 – Rules and Regulations Pertaining to Livestock Waste Control states:

> *001 A livestock waste control facility shall be required for an existing or proposed livestock operation of three hundred animal units or larger, when livestock wastes:*
>
> > *001.01 Violate or threaten to violate Title 117 (Neb. Administrative Code (NAC)), Nebraska Surface Water Quality Standards;*
> > *001.02 Violate or threaten to violate Title 118 (NAC), Ground Water Quality Standards and Use Classification;*
> > *001.03 Discharge into waters of the State; or*
> > *001.04 Violate The Nebraska Environmental Protection Act.*
>
> *002 Any livestock operation less than three hundred animal units is exempt from the permitting process, including the requirement to request an inspection, unless there has been a confirmed discharge into waters of the State, or the Department has determined that because of conditions at the livestock operation there is a high potential for discharge into waters of the State in which case the Department shall notify the owner of the livestock operation by certified mail that the owner is subject to the Livestock Waste Management Act.*

When a livestock waste control facility is required the owner/operator must also be issued a construction and/or a state-operating permit. State operating permits require facilities be properly operated and maintained to prevent water pollution and to protect the environment of the State.

Livestock waste control facilities for open lots, by regulation must be designed and constructed to contain all waste generated under conditions less than a 25 year 24 hour precipitation event. Confined animal feeding operations are required to maintain 180 days of storage or a lagoon to treat the waste products. Meeting these permit requirements should equate to “zero” discharge during conditions less than a 25 year 24 hour precipitation event, or a chronic wet period.

Wastewater and biosolids (manure) produced by the animal feeding operations are most often land applied for beneficial reuse. Permitted facilities are required to follow best management practices (BMPs) for the land application as defined in Title 130, Chapter 11. Those BMPs include:

1. Utilize application areas which are under proper conservation treatment to prevent run-off into waters of the State
2. Not apply waste within 30 feet of any stream, lake or impounded waters identified in Chapter 6 and Chapter 7 of Title 117, unless in accordance with an approved comprehensive nutrient management plan
3. When waste is applied within 100 feet of any streams, lakes an impounded waters identified in Chapter 6 and 7 of Title 117, the Department may also require additional buffer and/or vegetative buffers, and that the livestock waste be applied in a manner which reduces potential for run-off of nutrients or pathogens by incorporation, injection of waste or other approved practices.

Based upon the above, it shall be recommended that the NDEQ's Agriculture Section stipulate in the state operating or other permits, for facilities located in the Loup Basin, that the application of livestock waste occurring during or 10 days prior to the Recreation Season (May 1 – September 30) be consistent with the above #1 and #2 and the application setback be the minimum of 30 feet regardless of the status of the comprehensive nutrient management plan. In those areas where land slope or drainage is such where the application has a greater potential to run-off, or where application has been observed to have run-off, the recommendation will be consistent with the requirements of #3 with the minimum setback being 100 feet.

3.5 Exempt Facilities/Other Agricultural Sources

Animal feeding operations are exempt from regulations set forth in Title 130 if:

- The operation is less than 300 animal units
- There has not been a confirmed discharge to waters of the State, or
- The Department has determined that because of conditions at the livestock operation there is not a high potential for discharge to waters of the state.

Periodically, the NDEQ will receive a complaint on or a request for an inspection from a facility operating with <300 animal units. Should deficiencies be noted during the on-site visit, the owners/operator will often be given an opportunity to make corrections prior to enforcement or permit action being taken. In the event the efforts at voluntary compliance fail, civil enforcement or the issuance of a permit will be pursued to bring about the necessary corrective measures.

Because these facilities are "non-regulated", it is difficult to assess the impacts to the environment. As well, pastures or other temporary feeding practices may contribute to the *E. coli* impairments if conditions are such that run-off from the site occurs. In lieu of regulatory requirements, several USDA-Natural Resource Conservation Service programs are available for assisting individual landowners in the control of pollutant run-off. These programs include the Conservation Reserve Program, Environmental Quality Incentives Program, Conservation Farm Option, Conservation of Private Grazing Land Initiative, the Wetlands Reserve Program and others that aid in the maintenance and improvement of water quality.

3.6 Section 319 – Nonpoint Source Management Program

The United States Environmental Protection Agency supplies grant funds to states to aid in managing nonpoint source pollution. When grant applications are submitted for review, an effort should be made to include the control of *E. coli* and surface run-off for the proposed projects in the Loup Basin. As well, an effort will be made to redirect applicants to develop proposals consistent with the goals of this TMDL. Preference may be given to those projects that will have a direct reduction in the *E. coli* contributions of nonpoint source discharges.

3.7 Non-Government Organizations

Several non-governmental organizations with an emphasis on agriculture disseminate information to their members on a regular basis. As well, some of the organizations have established environmental education programs to assist in the understanding of environmental regulations and topics. The NDEQ will communicate with these entities in an attempt to utilize the membership distribution process as a means of providing information on the water quality impairments, the TMDL and suggestions to assist in solving the identified problems.

3.8 Reasonable Assurances

The NDEQ is responsible for the issuance of NPDES or state operating permits for industrial and municipal wastewater discharges, regulated stormwater discharges and livestock operations (open lot or confined). Issued permits must be consistent with or more stringent then the wasteload allocations set forth by this TMDL. Compliance with the permit may require construction or modification of a facility and the issued permits may account for this through the inclusion of a compliance schedule or administrative order.

Effective management of nonpoint source pollution in Nebraska necessarily requires a cooperative and coordinated effort by many agencies and organizations, both public and private. Each organization is uniquely equipped to deliver specific services and assistance to the citizens of Nebraska to help reduce the effects of nonpoint source pollution on the State's water resources. While a few of the organizations have been previously identified, Appendix A is a more complete compilation of those entities that may be included in the implementation process. These agencies have been identified as being responsible for program oversight or fund allocation that may be useful in addressing and reducing *E. coli* contributions to the Loup River. Participation will depend on the agency/organization's program capabilities.

4.0 Future Monitoring

Future monitoring will generally be consistent with the rotating basin monitoring scheme. That is, annually, two or three river basins in the same geographic location are the focus of the monitoring effort. The Loup River Basin was monitored in 2003 and will again be targeted in 2008. An effort will be made to expand the monitoring to isolate areas of concern and to focus resources to address identified problems.

Periodically, compliance monitoring will be conducted at NPDES permitted facilities to verify permit limitations are being adhered to. Facilities are selected either randomly or in response to inspection or reported information.

As well, the NPDES permits require self-monitoring of the effluent by the permittee with the frequency of the monitoring being based on the discharge characteristics. The data is then reported to NDEQ quarterly, semiannually or annually and entered into the EPA's Permitting Compliance System. The compliance monitoring and self-monitoring information will be used in assessing the success of the TMDL.

Recently, analytical techniques have been introduced that may provide a greater level of confidence in the identification of pollutant sources. These techniques include microbial source tracking and specialized sampling the targets human wastewater. As the science progresses the application of these analytical techniques may become a valuable tool for source identification and pollutant reduction.

5.0 Public Participation

The availability of the TMDLs in draft form was published in the Columbus Telegram, Custer County Chief, Ord Quiz, Phonograph-Herald (Howard County) and the Sherman County Times with the public comment period running from approximately October 10 2005 to December 1, 2005. These TMDLs were also made available to the public on the NDEQ's Internet site and interested stakeholders were informed via email of the availability of the draft TMDLs. No comments were received during the public participation period.

6.0 References

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Appendix A – Federal, State Agency and Private Organizations Included in TMDL Implementation.

FEDERAL

- Bureau of Reclamation
- Environmental Protection Agency
- Fish and Wildlife Service
- Geological Survey
- Department of Agriculture - Farm Services Agency
- Department of Agriculture - Natural Resources Conservation Service

STATE

- Nebraska Association of Resources Districts
- Department of Agriculture
- Department of Environmental Quality
- Department of Roads
- Department of Water Resources
- Department of Health and Human Services
- Environmental Trust
- Game and Parks Commission
- Natural Resources Commission
- University of Nebraska Institute of Agriculture and Natural Resources (IANR)
- UN-IANR: Agricultural Research Division
- UN-IANR: Cooperative Extension Division
- UN-IANR: Conservation and Survey Division
- UN-IANR: Nebraska Forest Service
- UN-IANR: Water Center and Environmental Programs

LOCAL

- Natural Resources Districts
- County Governments (Zoning Board)
- City/Village Governments

NON-GOVERNMENTAL ORGANIZATIONS

- Nebraska Wildlife Federation
- Pheasants Forever
- Nebraska Water Environment Association
- Nebraska Corn Growers Association, Wheat Growers, etc.
- Nebraska Cattlemen's Association, Pork Producers, etc
- Other specialty interest groups
- Local Associations (i.e. homeowners associations)

Appendix B – *E. coli* Data Collected in 2003 from Loup River Basin

Monitoring information collected during the recreation season in 2003 was not only obtained from sites on the segments assigned the recreation beneficial use but also from several tributaries. These sites were chosen based upon the location of a USGS or NDNR gage or if the waterbody was considered a major tributary. The locations of the sites are shown in Figure B1. Table B1 then provides a summary of the tributary monitoring information.

Figure B1. Monitoring Locations in the Loup River Basin – 2003

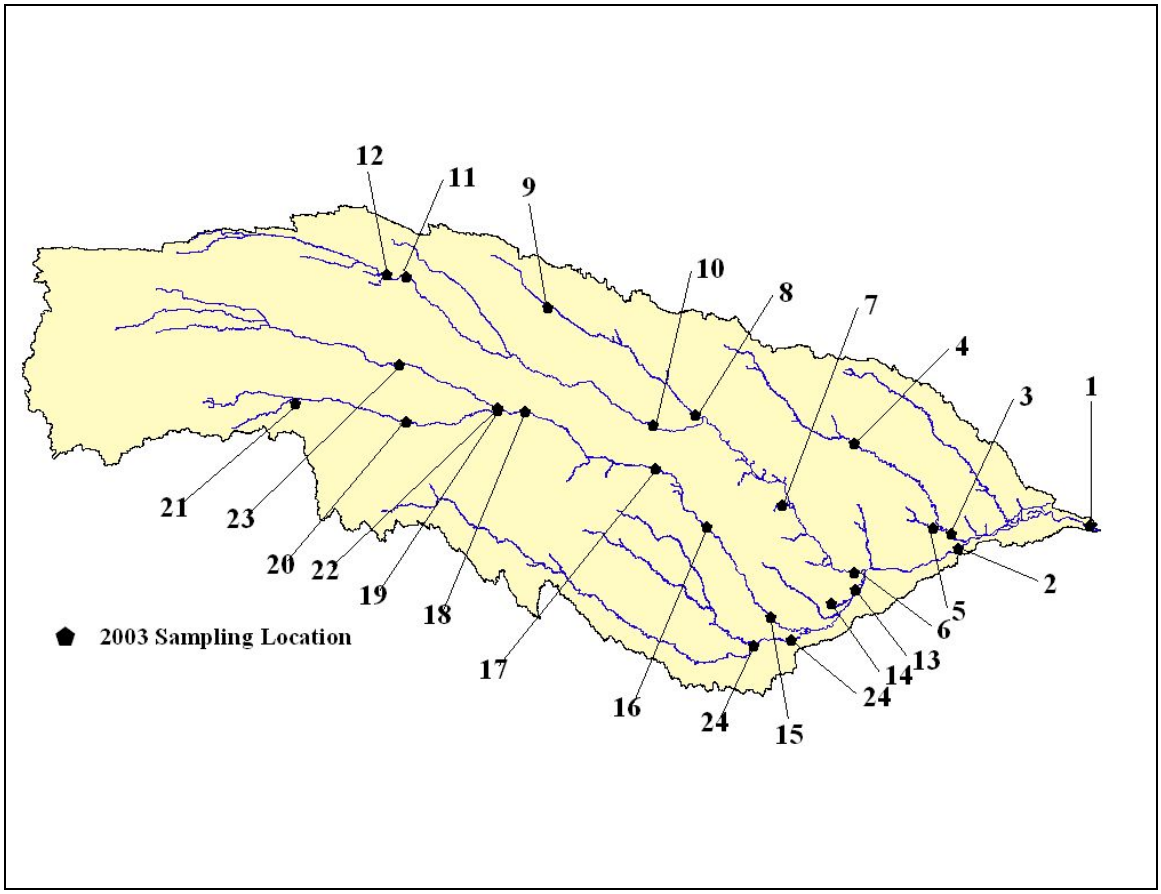

Table B1. Summary of 2003 Monitoring from Loup River Basin

Map Site ID	Segment	Title 117 Identification	Location	Number of Samples	Recreation Season Geometric Mean
1	Loup River	LO1-10000	Columbus	22	576
2	Loup River	LO1-30000	Fullerton	22	189
3	Cedar River	LO1-30300	Near Fullerton	22	444
4	Cedar River	LO1-30300	Spalding	22	402
5	Timber Creek	LO1-30310	Near Belgrade	22	1014
6	North Loup River	LO2-10000	St. Paul	22	195
7	Mira Creek	LO2-10400	North Loup	23	885
8	Calamus River	LO2-11300	Below Calamus Reservoir	23	15
9	Calamus River	LO2-11400	North of Brewster	22	328
10	North Loup River	LO2-20000	Taylor	23	87
11	North Loup River	LO2-30000	East of Brownlee	22	148
12	North Loup River	LO2-40000	Brownlee	22	205
13	Middle Loup River	LO3-10000	St. Paul	22	203
14	Turkey Creek	LO3-10200	Dannebrog	22	674
15	Middle Loup River	LO3-20000	Rockville	22	78
16	Middle Loup River	LO3-30000	Arcadia	23	102
17	Middle Loup River	LO3-40000	Sargent	23	44
18	Middle Loup River	LO3-50000	East of Dunning	22	39
19	Dismal River	LO3-50100	Dunning	22	44
20	Dismal River	LO3-50200	South of Thedford	22	108
21	Dismal River	LO3-50300	South of Mullen	22	246
22	Middle Loup River	LO3-60000	North of Dunning	22	21
23	Middle Loup River	LO3-70000	East of Thedford	22	124
24	South Loup River	LO4-10000	St. Michael	22	329
25	South Loup River	LO4-20000	South of Ravenna	22	392